ANCIENT INDIA

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NOTES

THE political changes that came in the wake of partition in 1947 have necessitated a re-organization of the Department of Archaeology. The country was severed both along the eastern and western ends, the cut across the north-west running through regions of great importance so far as the chalcolithic civilization of India is concerned. At the same time, this loss was more than compensated by the integration of States which have brought new responsibilities to the Department not only for the preservation of monuments of national importance but also for all other kinds of archaeological work in regions which now constitute Part B States, i.e. viable States or Unions of States, and Part C States or such parts of small States as have merged into Part A States. The monuments in the former Provinces (now Part A States) have been with the Department, but those in Part C States, which are centrally administered, with the exception of those in Ajmer, Coorg and Delhi, as well as the ancient and historical monuments and archaeological sites and remains which will be declared by Parliament to be of national importance, will also be the responsibility of the Centre. By this arrangement, the Department, which was operating over an area of 7·3 lakh square miles, will have to spread out its organization over an additional area of 3·9 lakh square miles owing to the integration of the erstwhile States.

It is a pity, however, that the increase in the responsibility of this Department synchronizes with a time of financial stringency at the Centre, and we shall, therefore, have to be content with extending the organization to the very minimum, consistent with efficiency. In pursuance of this, inevitably most of the existing Circles are expected to be re-aligned and their territorial limits re-adjusted, as far as possible, on considerations of cultural homogeneity, compactness, administrative facility and economy. The revised set-up is calculated to bring about a clearer visualization of the local archaeological problems and better planning on a regional basis over the whole of India. Needless to say that all this arrangement, to be operative, would take some time.

* * * * * * * *

Some of the Part B States, such as Hyderabad, Madhya Bharat, Mysore, Rajasthan and Travancore-Cochin, and some of the Part C States also, such as Bhopal and Vindhya Pradesh, have been maintaining archaeological departments of their own. While work carried out by them to monuments in their respective jurisdictions and the publications made by them will be of help to the Department, yet, at present, the Centre is, at best, acquainted only with important monuments in these States, and has to inform itself further about many more and also about the present condition and needs of all monuments in general. The remaining Part B States, had never had any archaeological departments. Over such areas a systematic archaeological survey for the purpose of scientific listing of monuments is necessarily called for. This survey will embrace adequate descriptions of monuments, their present condition, ownership, classification as well as recommendations for their future upkeep. A problem of common interest throughout India would be to co-ordinate the standards of conservation work on monuments, over 500 of which, being of national importance in Part B and C States, are expected to be taken over by us for the first time. This would entail considerable work including drawing and photographic recording. Further archaeological work would compel exploration of the areas which have never been properly surveyed as far as ancient sites and remains underground are concerned and also for the epigraphical wealth contained in them and scattered about in the countryside. Here alone our loss of the great chalcolithic sites of Harappā and Mohenjo-daro and numerous other contemporary sites of that culture might possibly be made up by systematic work in Rajasthan and Cutch, as geographically an extension of the Harappā culture may quite naturally be expected over these regions. Accordingly, exploration in the valleys of the dried-up rivers Sarasvatī and Dṛishadvatī—hallowed names in hoary past—has been started in Bikaner. An early series of settlements representing the culture of Harappā and Mohenjo-daro city-sites has already been traced, and there are other sites of Harappan affinities with slight differences in pottery-fabric and types, suggesting an eastern variety of that culture, as well as another group with painted grey ware and associated pottery distinct both from the Harappā wares and those of the succeeding cultures. This latter group corresponds to the painted grey ware of PEPSU, Panjab (India) and west U.P. Of late, this has assumed importance as the potential interlocking key to the dark period. Painted grey ware, besides the sites traced in Bikaner, has been observed to occur at Ahichchhatrā, Hastināpura, Barnāwā, Bāghpat, Tilpat, Pānipat, Mathurā, etc. Interesting facets of a late prehistoric culture involving the occurrence side by side of a red-on-black painted ware and microliths have been brought to light in a number of places in western India, where pottery akin to Northern Black Polished ware has also been observed to occur. This, indeed, is a most welcome link in the chain of cultures that bind the cis- and trans-Vindhyan country, and it is likely to furnish a chronological correlation with the megalithic sites of the Deccan and South.

* * * * * * * *

The field of conservation will be materially enlarged, and the variety of problems raised by monuments of different classes infinitely multiplied when we think of the famous temples at Khajurāho, the Buddhist *stūpas* at Sānchī, the fort at Gwalior, the late medieval palace at Datiā, or the famous cave temples of Bāgh, Ajanṭā and Ellorā, or the delicate Hoysaḷa monuments at Somnāthpur, Haḷebīḍ and Belūr in Mysore, both for their architectural wealth and the exquisite variety of detail or sculptures contained in them. The preservation of mural paintings alone at Bāgh, Ajanṭā and Ellorā, in the palaces of Tippu Sultān at Seringapatam, Mattancheri at Cochin and at Padmanābhapuram near Trivandrum, not to mention similar paintings and miniatures of the Gujarat and Rajasthani schools scattered over these regions and the Pahari school of paintings in Chambā and elsewhere, will require all the resources the Department commands in chemical preservation.

MADHO SARUP VATS

PLANT-REMAINS FROM HARAPPĀ 1946

By K. A. Chowdhury and S. S. Ghosh

In this article the Wood Technologist and the Assistant Wood Technologist of the Forest Research Institute have, at the request of the Department of Archaeology, once more dealt with ancient plant-remains, this time with those found in Dr. R. E. M. Wheeler's 1946-*excavation at Harappā, reported on in* Ancient India, *no.* 3 (*January* 1947), *pp.* 58 *ff. Owing to the highly deteriorated condition of the specimens, the task of examining and identifying them involved much more than the normal care and patience, but it is a matter of gratification that in spite of the difficulties the identifications are definite. Of great significance are the authors' inferences* (*p.* 17) *regarding the climatic conditions of the region in which some of the identified trees grew.*

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1. INTRODUCTION

CONSIDERABLE information on the Harappā culture has been made available during the past three decades, but not much attention has till now been paid to the botanical remains recovered in the different excavations. This paper deals with some of the plant-remains collected during the 1946-excavation. Owing to the bad state of deterioration, the recovery of the plant-material has been very slow, though it has ultimately been possible to gather the remains of four timbers and to identify them as deodar (*Cedrus deodara* Loudon), rosewood (*Dalbergia latifolia* Roxb.), ber (*Zizyphus* sp.) and elm (*Ulmus* sp.). All these are well-known commercial timbers of the present day.

Two of these timbers were used for a coffin, the only discovered specimen of its type in the Indus valley cultures.[1] The archaeological and botanical significance of these finds is discussed below (pp. 12-17).

2. MATERIALS

The Director General of Archaeology in India sent us four packing cases, the contents of which were as follows :—

1. The case marked HP XXIX-128 contained five blocks of earth showing marks of planks (pl. I,1 and fig. 1), very clearly indicating the four walls of a coffin.[2]

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[1] *Ancient India*, no. 3 (January, 1947), p. 87.

[2] *Ibid.*, p. 87.

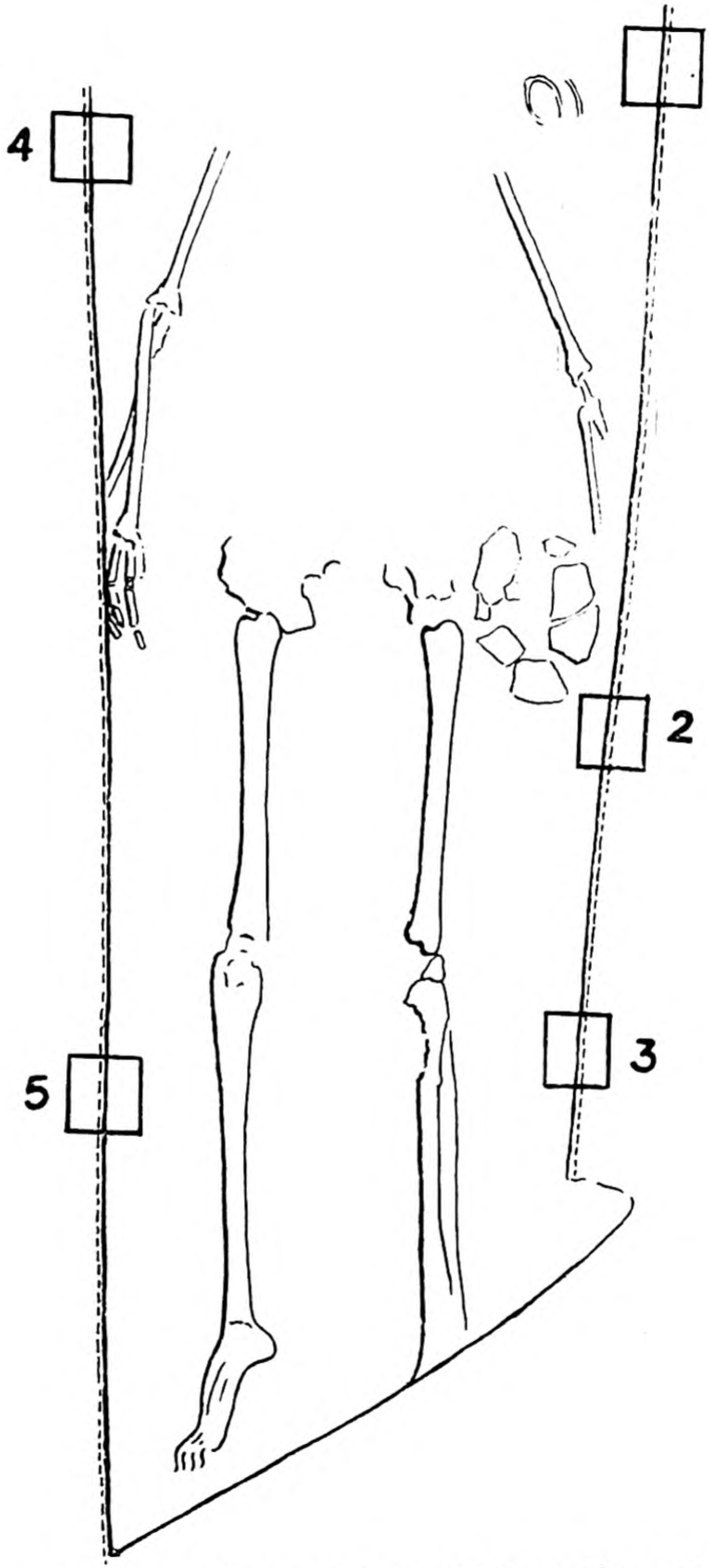

FIG. 1. *Marks of coffin-wall from which five samples were taken out*

2. The case marked HP XXIX-129 contained blocks of earth showing remnants of the so-called shroud from the same burial (pl. I, 4).

3. The case marked HP XLIV-1 contained surface-soil from the depression in the centre of a circular platform.[1]

4. The case marked HP XLIV-2 contained deposits from over the same platform

3. METHODS OF STUDY

It was realized from the beginning that the identification of the plant-remains, if at all possible, would take a considerable time, but the difficulties encountered in the process were beyond expectation. Various laboratory techniques were tried, but none gave satisfactory results except the method stated below. Depending on the state of deterioration the method was used either in its entirety or in a modified form. For instance, double embedding was necessary for the materials from the coffin and the shroud but not for those from the platform, for which celloidin embedding was good enough. Altogether about two hundred mounts were prepared and examined.

The first-aid given in the field, consisting of soaking the clods of earth cut from the grave in 2·5 per cent vinyl acetate and then coating with shellac, had no doubt kept the blocks intact but did not facilitate our work. The shellac coating obscured visibility. Light treatment with toluene with a fine brush had to be resorted to in order to obtain a clear view of the plant tissues embedded in the blocks of soil. The details of the rest of the method were as follows :—

1. Pick up with a knife small bits of plant-tissues or what appeared to be plant-tissues.
2. Soak them in water for a few days and try to remove loose soil-particles.
3. Transfer to test-tubes, add water and centrifuge.
4. Transfer to watch-glass and stain with a few drops of methylene blue. This facilitated easy detection of the plant-material under a microscope.
5. Collect the tissues and wash them in acid-alcohol. Change acid-alcohol daily to remove soil particles still adhering.
6. Transfer to Eau-de-Javelle and remove quickly fine soil-particles with a brush.
7. Wash in 50 per cent alcohol and go up to alcohol-ether.
8. Transfer each bit to a petri dish containing 2 to 4 per cent celloidin and dry.
9. Turn over the material and cover it again with celloidin. When dry, cut out the bits of tissue with celloidin and transfer to embedding phials.
10. Follow the usual celloidin embedding process upto 20 per cent celloidin and harden in chloroform.
11. Embed in paraffin.
12. Cut sections on a rotary microtome.
13. Stain and mount in balsam.

At the fifth stage some tissues were found to be too small for cutting section. These were left in acid-alcohol for a day or two, then treated with potassium hypochlorite (Eau-de-Javelle) and finally mounted in *toto*.

A method used for pollen analysis by Dr. H. Godwin[2], Botany School, Cambridge, England, was also tried with some modification. The results obtained were fairly satisfactory.

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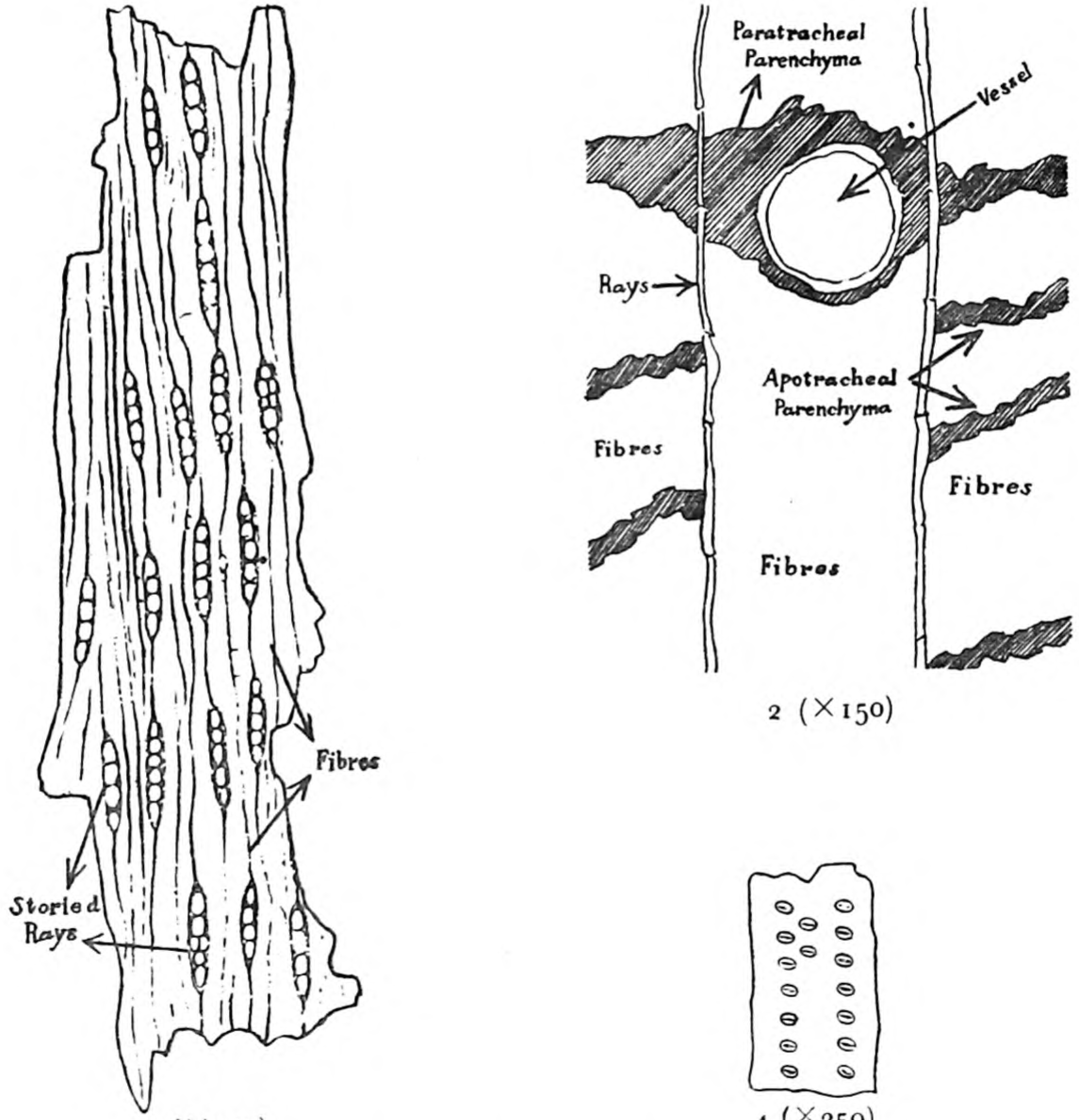
[1] *Ancient India*, no. 3, p. 78.

[2] Information from Dr. Godwin.

4. RESULTS OF STUDY AND IDENTIFICATION OF PLANT-REMAINS

A. MATERIAL FROM HP XXIX-128 (COFFIN-WALLS)
(pl. I, 1-3 and figs. 1-4)

ANATOMICAL DESCRIPTION.—*Growth rings* are not traceable. This is probably owing to the small size of the available cross-sections (pl. I, 2). Only a few *vessels* have been noticed ; their distribution appears to be scanty. By mounting lumps of tissues, it has however been possible to obtain longitudinal views of the vessels. They are short in length and without tyloses. Their perforation plates are simple, horizontal or nearly so. The intervessel pits are fairly large, oval, with lenticular orifice (fig. 4). *Fibres* are round to angular (pl. I, 2), irregularly arranged, non-septate. Their diameters vary from 7-24 microns, and wall-thickness is usually 4 microns. Their lumina are narrow to wide



2 (×150)

3 (×150)

4 (×250)

FIG. 2-4. *HP XXIX-128, 2, diagrammatic sketch of cross-section; 3, sketch of tangential section showing ripple-marks; 4, drawing of intervessel pits*

TABLE I

Comparative anatomical structure of the wood from Harappā as well as Dalbergia lanceolaria, D. latifolia and D. sissoo, *and* Pterocarpus marsupium *and* P. santalinus *and their present geographical distribution in India*

Timber species	*Anatomical structure*					*Distribution*
	Ripple marks	*Height of rays in cells and microns*	*Width of rays in cells and microns*	*Paratracheal parenchyma*	*Apotracheal parenchyma*	
1. Wood from Harappā (coffin-walls)	Present, about 175 per inch	4-6 cells, 75-195 microns	1-2 cells, 15-30 microns	One to several seriate sheath, aliform to aliform-confluent	1-2 seriate	
2. *Dalbergia lanceolaria* Linn.	Always present, 130 per inch	4-12 cells, up to 25-cells ; usually 130-220 microns or more	1-4 cells, 13-40 microns	One to two seriate sheath inconspicuous, seldom aliform-confluent	Abundant, usually one seriate in broken tangential lines	Western Peninsula as far as Ajmer, in the north up to Siwāliks, and in the east upto Bihar
3. *Dalbergia latifolia* Roxb.	Always present, 165-175 per inch	4-6 cells, 80-150 microns	1-2 cells, occasionally 3 cells, 30-45 microns	One to several seriate sheath, aliform to aliform-confluent	1-2, occasionally 3 seriate	In the north up to Oudh and Marwāra extending to the west up to Panchmahal, in the east up to north Bengal and throughout Peninsular India
4. *Dalbergia sissoo* Roxb.	Not always present, when present 150 per inch	6-15 cells, sometimes up to 25 cells, 140-215 microns	1-4 cells, 45-65 microns	One to several seriate sheath, aliform-confluent	One to several seriate in tangential lines	From the Indus to Assam throughout sub-Himalayan tract, also Baluchistan
5. *Pterocarpus marsupium* Roxb.	Always present, 110-120 per inch	6-10 cells, 140-200 microns	1-3 cells, 25-40 microns	One to several seriate sheath, mostly aliform-confluent	Scanty, 1-2 cells seriate	Northern limit Haldwāni and Mt. Abu and eastern limit Bengal. Through out central and south India
6. *Pterocarpus santalinus* Linn.	Always present, 125-135 per inch	10-12 cells, 140-215 microns	1-2 cells, 20-28 microns	1-2 seriate sheath, usually aliform-confluent	Scanty, 1-2 cells seriate	Confined to Cuddapah district and its surrounding areas in Madras

(pl. I, 2). *Parenchyma* cells are both paratracheal and apotracheal. The paratracheals show a tendency to form aliform to aliform-confluent structure. They are usually in several rows (pl. I, 2 and fig. 2). The apotracheals are in rows of 1-2 cells, mostly single. They run short distances often forming somewhat alternate bands with those of the fibres (pl. I, 2 and fig. 2). Both types are 17-31 microns in diameter and occasionally contain darkish deposits. *Rays* are 1-2 seriate (pl. I, 3 and fig. 3). They are arranged in 'echelon' and form distinct ripple-marks which are about 175 per inch. Their width is 15-30 microns and height 4-6 cells and 75 to 195 microns. The individual ray cells are round to oval (fig. 3) and moderately thick-walled.

IDENTIFICATION.—The ripple-marks are formed by a regular arrangement of the rays, vessels and parenchyma cells. This structure and the distribution of paratracheal and apotracheal parenchyma suggest the affinity of the timber to the *Leguminoseae* and particularly to the genera *Dalbergia* and *Pterocarpus*. These two genera have some overlapping anatomical characters which make it somewhat difficult to separate them.[1] This difficulty can, however, be overcome provided, firstly, 'the limit of overlapping is clearly understood' and, secondly, their general features such as colour, grain, texture and lustre are known. The anatomical details of the genera are given in Table I (p. 7), but unfortunately the data on general features are missing in the timber from Harappā. A consideration of the present distribution of the genera was therefore thought advisable before the timber from Harappā was finally identified.

Amongst the Dalbergias now growing in India only three species are found in the north, namely *Dalbergia lanceolaria* Linn., *Dalbergia latifolia* Roxb. and *Dalbergia sissoo* Roxb.[2] In the genus *Pterocarpus* there are also two likely species, viz. *P. marsupium* Roxb. and *P. santalinus* Linn. The anatomical details of these five species and their present distribution are given in Table I. It will be seen that the timber under investigation shows greater affinities with the *Dalbergia* than with the *Pterocarpus*. The number of ripple-marks per inch and the distribution of paratracheal and apotracheal parenchyma cells of the timber from Harappā agree with those of the *Dalbergia*. Finally, amongst the Dalbergias, the timber shows the greatest similarity to *Dalbergia latifolia* and has, therefore, been identified as *Dalbergia latifolia*.

B. MATERIAL FROM HP XXIX-129 (SHROUD ?)
(pl. I, 4, 5, pls. II-III and figs. 5, 6)

ANATOMICAL DESCRIPTION.—*Growth rings* cannot be seen in any of the sections that have been cut. The cross-sections available only show the wood in between two growth marks (pl. I, 5 and pl. II, 1, 2). The arrangement of cells indicates that the transition from early to latewood is gradual. The timber is non-porous. *Tracheids* are squarish to rectangular, arranged in distinctly radial rows. The maximum tangential and radial diameters are 38 microns and 45 microns respectively (pl. II, 1, 2). The pits on the tangential walls are not clear. On the radial walls they are very prominently bordered. The margins of the tori are scalloped (pl. III, 3, 5). The crassulae are often clearly visible (pl. III, 5). *Vertical parenchyma* cells are scanty, mostly single. They are often clearly seen in longitudinal sections (pl. II, 4). *Resin canals* of vertical type have not been observed, but the horizontal type is undoubtedly present in the rays. The orifice of canal is often large and oval, showing traumatic origin (pl. II, 4 and fig. 5). *Rays* are of two types; uniseriate and fusiform (pl. II, 3, 4). The uniseriate rays are 1-28 cells and up to 600 microns in height (pl. II, 3). Their width is 15-30 microns. The fusiform rays are very wide in the centre. *Ray tracheids* are non-dentate and confined to marginal position (pl. III, 1 and fig. 6). They have small bordered pits which are not very clear. The cross-field pits are usually piceoid, occasionally cupressoid (pl. III, 2 and fig. 6).

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[1] K. A. Chowdhury, 'Some aspects of pure and applied wood anatomy', Presidential address, Botany Section, 35*th Indian Science Congress* (Patna, 1948), p. 77.

[2] D. Prain, 'The species of Dalbergia of South Eastern Asia', *Annals of the Royal Botanic Garden*, X, pt. 1 (Calcutta, 1904); D. Brandis, *Indian Trees* (London, 1921).

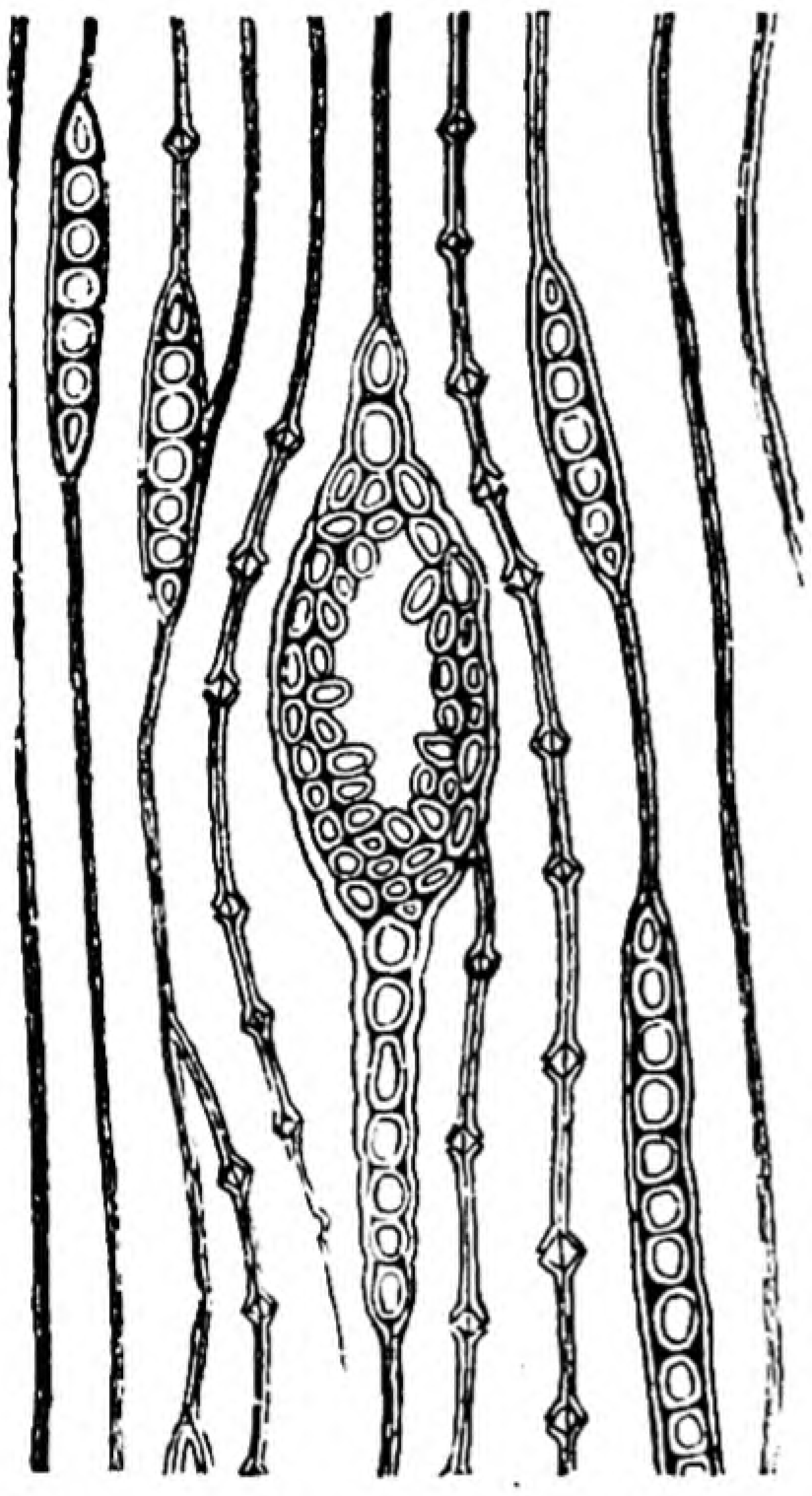

FIG. 5. Cedrus deodara, *tangential section showing fusiform and uniseriate rays* (×110)

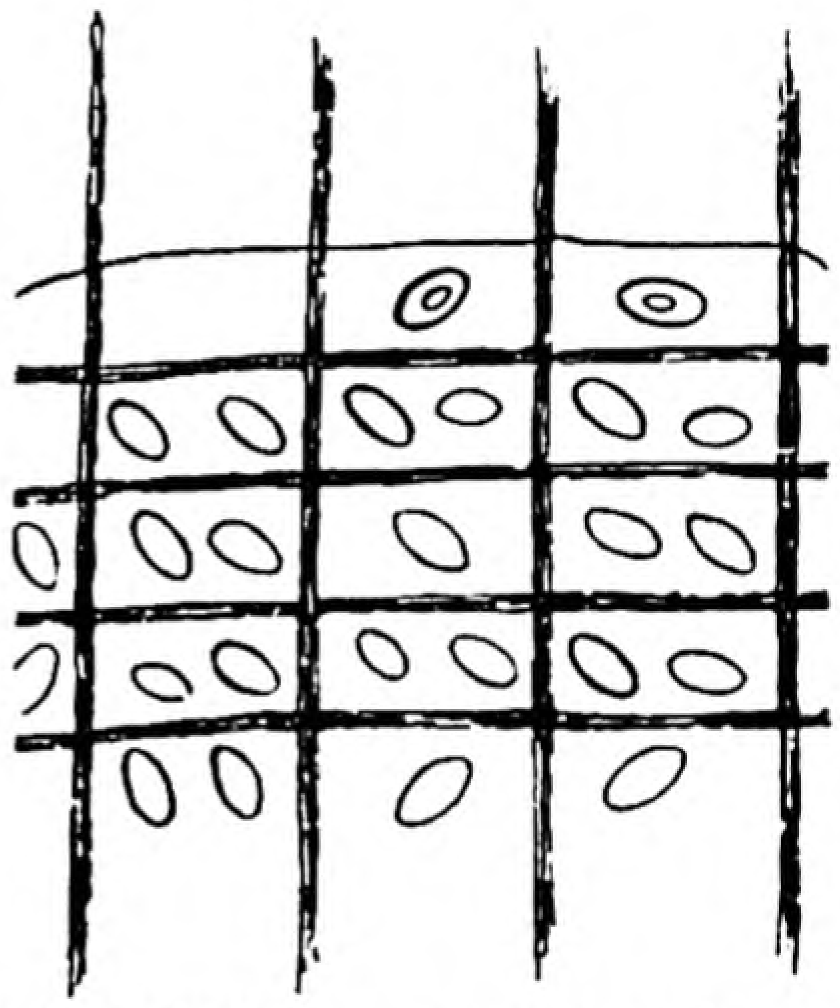

FIG. 6. *HP XXIX-129. Radial section showing pits on a marginal tracheid and cross-field pitting (diagrammatic)* (×400)

IDENTIFICATION.—The coniferous wood from Harappā shows scanty vertical parenchyma cells. This indicates its affinity to the *Pinaceae.*[1] The cross-field pittings match with those that belong to the sub-group *Abietoideae.* Furthermore, the normal vertical resin canals are absent but the horizontal type is occasionally present in the fusiform rays.[2] This is an indication that this wood is similar to *Cedrus.* This affinity is further confirmed by the presence of distinct scalloping of the tori of the bordered pits.[3] Four different species of Cedrus are recognized by the systematic botanists, but they have more or less similar anatomical structure and cannot be separated. The Harappā conifer is, therefore, named *Cedrus* sp., probably *C. deodara.*

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[1] E.W.J. Phillips, 'Identification of softwoods', *Forest Products Research Bulletin*, 22 (1948), pp. 1-56.

[2] M.A. Chrysler, 'The medullary rays of Cedrus', *Botanical Gazette*, 59 (1915), pp. 387-396.

[3] I. W. Bailey, 'The cambium and its derivative tissues, VII, Problems in identifying the wood of Mesozoic Coniferae', *Annals of Botany*, XLVII (1933), pp. 145-157; E. S. Barghoorn and I. W. Bailey, 'The occurrence of Cedrus in the auriferous gravels of California', *American Journal of Botany*, 25 (1938), pp. 641-647.

C. MATERIAL FROM HP XLIV-1 (FROM DEPRESSION OF THE CIRCULAR PLATFORM) (pl. IV, 1, 2, 3)

ANATOMICAL DESCRIPTION.—*Growth rings* are not traceable in the cross-sections available to us. *Vessels* are of small to medium size, single or in radial pairs of 2 to 4, mostly 3 (pl. IV, 1). Their tangential diameters vary from 60 to 115 microns. Length of the vessel elements varies from 375 to 645 microns. They are either tailed or not so; when tailed usually at both ends. Vessel perforation plates are simple, oblique to nearly horizontal. Intervessel pits are large, alternate and rather crowded (pl. IV, 3). *Fibres* are semi-libriform, non-septate, with a tendency for radial alignment. They are 10-24 microns in diameter. The pits on their walls are simple, and few and far apart. *Parenchyma* cells are mostly paratracheal forming vasicentric to aliform structure (pl. IV, 1). *Rays* are somewhat coarse, closely spaced, 1 to 2 seriate (mostly 1) and almost homogeneous. Individual ray cells are oval to oblong, often showing solitary crystals. Height of the rays is usually low, 1-14 cells and up to 450 microns. The width is 15-30 microns (pl. IV, 2, 3).

IDENTIFICATION.—The cross-sectional view of the wood indicates its general affinity with the families *Sapindaceae* and *Rhamnaceae*. A study of the distribution of the vessels, fibres and parenchyma cells shows great similarity to 2 genera, namely *Schleichera* of *Sapindaceae* and *Zizyphus* of *Rhamnaceae*.[1] Furthermore, the structure of the rays and pits on the walls of fibres and vessels of the material from Harappā show complete agreement with the *Zizyphus*. The genus *Zizyphus* is represented in India by about fourteen species,[2] of which six have been recorded from the north-western region.[3] In view of the fact that timbers of these species are not always possible to separate, the wood from Harappā is identified as *Zizyphus* sp.

D. MATERIAL FROM HP XLIV-2 (FROM ABOVE PLATFORM) (pl. IV, 4, 5, 6, 7, 8 and figs. 9, 10, 11)

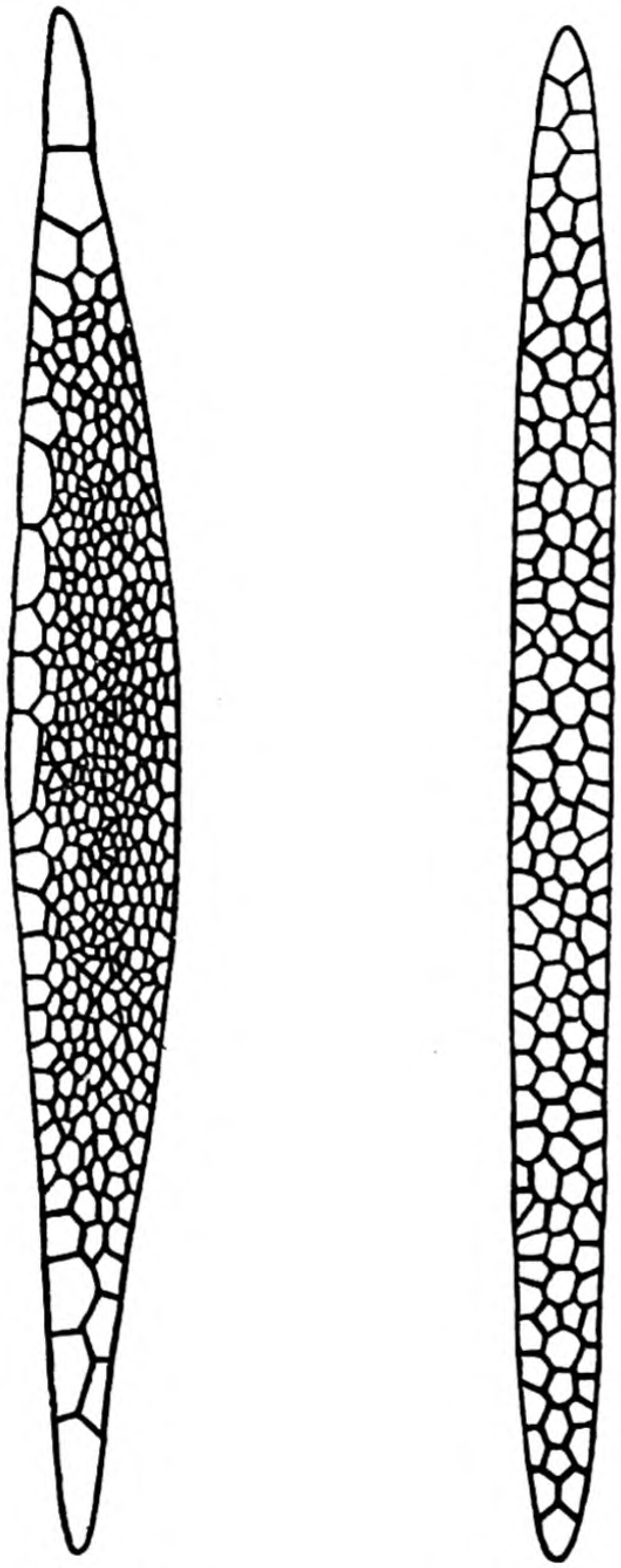
ANATOMICAL DESCRIPTION.—No entire growth ring is visible. Two cross-sections show growth marks and these are formed by 2 to 3 rows of parenchyma cells. From the structure visible in different microscope sections, it has been possible to build up a diagramatic drawing of the transverse section of the wood (fig. 9). *Vessels* are small to medium, 105 to 135 microns in tangential diameter (pl. IV, 4, 7, 8) and are moderately thick-walled, single or in radial pairs. The length of the vessels is short. The perforation plate is simple. The intervessel pits are alternate, round to oval with lenticular orifice (pl. IV, 6). The secondary walls show fine spiral thickening (fig. 11) *Fibres* are semi-libriform, arranged in an irregular fashion but forming a uniform pattern throughout. They are non-septate, fine, 7-19 microns in diameter. Their walls are 3-7 microns thick. *Parenchyma* cells at first appear to be terminal or initial. However, a careful examination shows that they are more like the initial than the terminal type. Paratracheal parenchyma cells are in rows of 1-4, forming a rugged pattern round the vessels. They are 14-27 microns in diameter. *Rays* are 3-4 seriate, mostly 3, almost homogeneous (pl. IV, 5 and figs. 10, 11). They are 45-75 microns wide and 630 microns high. The individual ray cells are large and oval and frequently contain gummy deposits. Some also show single crystals.

---

[1] R. S. Pearson and H. P. Brown, *The Commercial Timbers of India*, I (Calcutta, 1932).

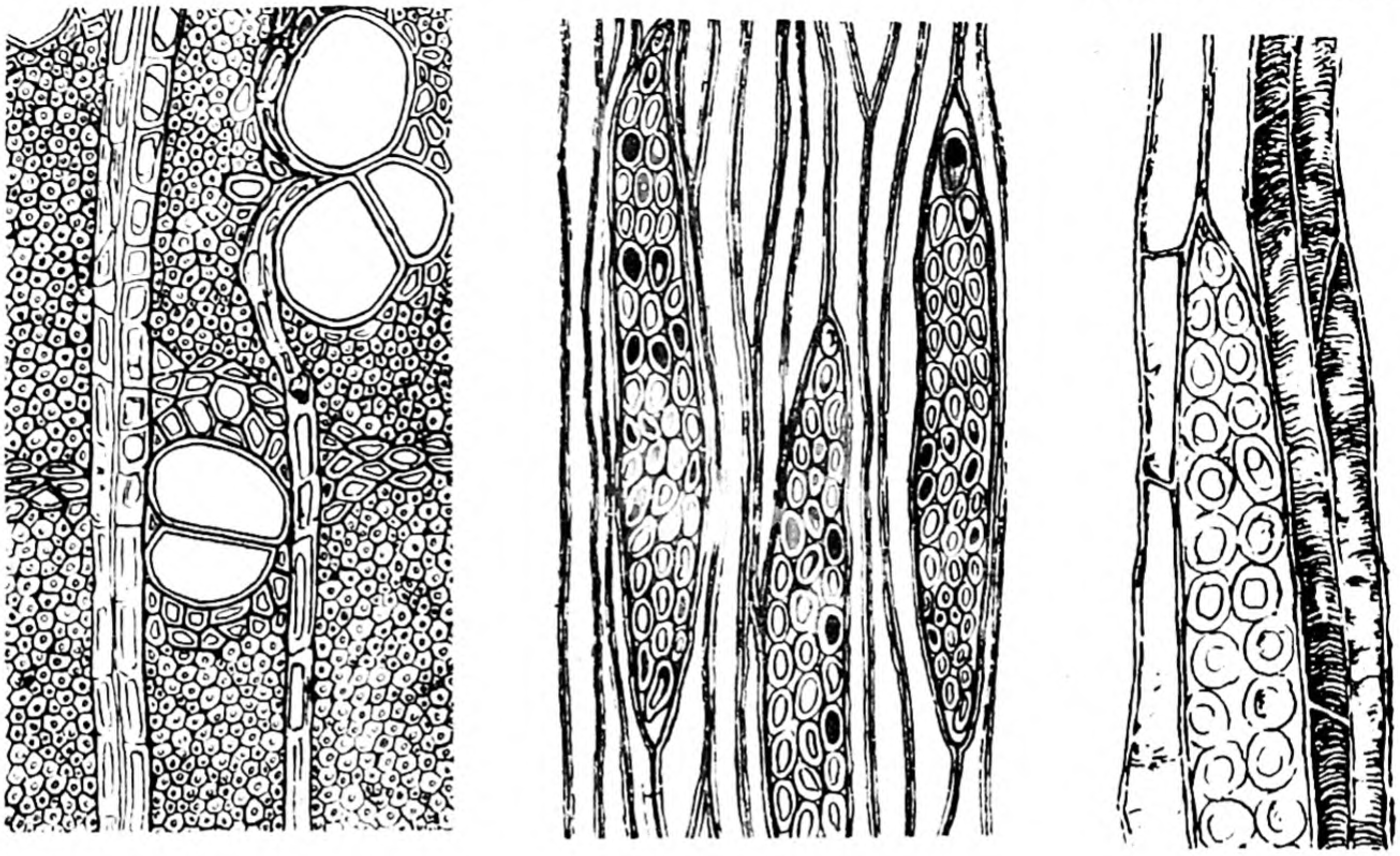
[2] D. Brandis, *op. cit.*

[3] R. N. Parker, *A Forest Flora for the Punjab* (Lahore, 1918).



7(×200) 8 (×200)

FIGS. 7-8. *Tangential views of rays.* 7, Celtis ; 8, Ulmus



9(×150) 10(×150) 11(×400)

FIGS. 9-11. *HP XLIV-2, diagrammatic sketches.* 9, *transverse section* ; 10, *tangential section showing rays* ; 11, *tangential section showing vessels with spiral thickening on the right-hand side*

IDENTIFICATION.—The semi-ring porous structure of the wood gives a valuable clue to its identity. Furthermore, the rays are broad ; the scanty parenchyma cells are mostly confined round the vessels. These anatomical features, plus the peculiar pattern formed by the fibres, indicate the affinity of the timber with the genera *Celtis* and *Ulmus* of the *Ulmaceae*. It is well-known that the minute anatomical structure of the woods of *Celtis* and *Ulmus* is similar except for the rays.[1] The rays of *Ulmus* are almost homogeneous,[2] while those of the *Celtis* are distinctly heterogeneous,[3] often showing prominent sheath cells[4] (figs. 7, 8). The wood from Harappā with its homogeneous rays should, therefore, be grouped along with the *Ulmus*. Four species of *Ulmus*, namely *U. lancifolia*, *U. parvifolia*, *U. villosa* and *U. wallichiana* grow in India. Of these, all. show ring-porous character except *U. lancifolia*, which is semi-ring-porous. An affinity of the Harappā material with *U. lancifolia* is therefore evident. But we do not feel inclined definitely to identify it as *U. lancifolia* for reasons given below (p. 15). The timber from Harappā is identified as *Ulmus* sp., belonging to the group which has diffuse-porous to semi-ring-porous wood.

5. DISCUSSION

A. ARCHAEOLOGICAL SIGNIFICANCE

The first coffin recovered from the Indus valley is made of two timbers. The side-walls are rosewood (*Dalbergia latifolia* Roxb.) and top-plank covering the upper portion of the body is deodar (*Cedrus deodara* Loudon). The coffin is stated to be 7 ft. long and 2 to 2½ ft. (towards the head) wide.[1] Its height and shape are not known for all that was left of it was the marks of its side-walls about 1½ in. thick. The excavator has reported that 'traces of a reed-shroud, available from the pelvic girdle to the upper vertebrae, were also met with'. But when microscopic examination of the traces of the supposed reed-shroud was made, it yielded only deodar wood. Proof of a reed-shroud is therefore absent. This point will be further discussed later on.

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[1] H. P. Brown and others, *Text Book of Wood Technology*, I (New York, 1949).

[2] S. H. Clarke in *Forest Products Research Bulletin*, no. 7 (1930).

[3] O. Tippo, 'Comparative anatomy of Moraceae and their presumed allies', *Botanical Gazette*, 100, no. 1 (1938).

[4] C. R. Metcalfe and L. Chalk, *Anatomy of the Dicotyledons*, II (Oxford, 1950).

The question now arises whether coffin-burial was in practice in Vedic India. The *Ṛigveda-saṁhitā* merely mentions the burial of a warrior and nothing more, while the *Atharvaveda-saṁhitā* contains reference to a burial where the trunk of a tree was used as coffin. In both the *Saṁhitās* we find mention of a 'house of earth' (*bhūmigṛiha*) for burial.[2] It will, therefore, be seen that there is no mention of the type of burial met with at Harappā.

On the other hand coffin-burial was a common practice in the Near Eastern civilizations.[3] The available information on the timbers[4] used by them in the construction of coffin is given in Table II (below, p. 14). The timbers have been used in two forms, firstly as plywood, and secondly as solid timber. Except for the Old Egyptian Kingdom, all the coffins appear to have been made of solid planks. An important point is that the timbers so far recorded for the coffin from Iraq and Egypt are well-known for the scent they have, e.g. cypress, juniper, cedar and pine. At Harappā also one of the timbers used is cedar or deodar. The other timber is rosewood, which is also known for its sweet scent. The remarkable similarity in the choice of wood for the coffin at Harappā on one hand and Iraq and Egypt on the other may not be without any significance. This point is especially emphasized in the use of rosewood. When a substitute was used, it had to be a scented wood.

As has been stated above the results of our examination of the Harappā specimens do not allow us to conclude that there was a shroud, made of 'reed or matting'. However, a mark dividing the body from the pelvic girdle to the upper vertebrae was noticed. How this mark came about we do not know, but it might have been created by the wooden planks used for the coffin, about the construction of which we know nothing.

It is important to note in what way the coffin-burial at Harappā resembles or differs from the Mesopotamian ones. The identification of deodar wood as covering the upper part of the body does not in any way go against Wheeler's conclusion on the similarity of coffin-burial between the Harappā and the Sumerian civilizations. For, Woolley states that in the Sargonic and pre-Sargonic graves at Ur 'the dead man was laid at the bottom of the shaft either wrapped in matting or enclosed in a coffin which might be made of matting, of reeds, or wickerwork, of wood or of clay'.[5] Thus, the microscopic examination of the remains of the Harappā coffin provides an additional proof of a possible connexion between the Indus valley and Sumer.

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[1] *Ancient India*, no. 3 (1947), p. 87.

[2] For the Vedic evidence, see A. A. Macdonnell and A. B. Keith, *Vedic Index* (London, 1912), I, p. 8, and II, p. 319.

[3] H. R. Hall in *Antiquity*, 2 (1928), pp. 56-68 ; R. Mond and O. H. Myers, *Cemeteries of Armant*, I (London, 1937) ; H. Schäfer in *Sitzungsberichte der Preussischen Akademie der Wissenschaften*, 1931 (Berlin).

[4] W. Ribstein, *Zur Kenntnis der im alten Aegypten Verwendaten Holzer* (1925) ; also L. Keimer, *Die Gartenpflanzen im alten Aegypten* (Berlin, 1924) ; R. Engleback in *Annales du service des antiquities de l'Egypte*, 31 (1931) ; A. Lucas in *Empire Forestry Journal*, 13, no. 2 (1934), pp. 213-218 ; A. Lucas in *Annales du service des Antiquities de l'Egypte*, 36 (1936).

[5] C. L. Woolley, *Ur Excavations II : The Royal Cemetery* (London and Philadelphia, 1934), pp. 135 ff.

TABLE II

Woods used for coffins and shrines over tombs

Place	*Date*	*Solid timber or ply-wood*	*Names of timbers*
Egypt	About 2980 to 2475 B.C. (Old Kingdom)	Six-plywood	1. Cypress (*Cupressus*) 2. Juniper (*Juniperus*) 3. Pines (*Pinus*) 4. Cedar (*Cedrus*) (?)
Egypt	About 2160 to 1788 B.C. (Middle Kingdom)	Solid wood	1. Cedar (*Cedrus*)
Egypt	About 1350 B.C. (tomb of Tut-ankhamen)	Solid wood	1. Cedar (*Cedrus*) 2. *Zizyphus spina christi*
Ur	About 2000 B.C.	Solid wood (?)	Not reported
Harappā	About 2000 B.C.	Solid wood	1. Deodar (*Cedrus*) 2. Rosewood (*Dalbergia latifolia*)

The plant-remains from the depression of the circular platform have yielded the wood of *Zizyphus*. According to Wheeler, ' the platform surrounded a wooden mortar where grain was pounded by one or more workers with long pestles '. This style of pounding grain is still prevalent in north India, and, what is more important, the trunk of Zizyphus tree is preferred to any other. It is remarkable that for the last four thousand years Zizyphus trunk has been in use for the construction of mortar for pounding grains and modern science has brought about no change.

We do not know for what purpose the wood of elm was used and got deposited over the platform. There is no doubt that the tree was not available near about Harappā.[1] It is a mystery how it came there from such a long distance and for what special use.

B. Botanical significance

Archaeologists have discussed at length the various evidences that have led them to draw conclusions on the climate and the vegetation of north-west India during the Harappā culture. They are of the opinion that millions of kiln-baked bricks used for the construction of the city meant an easy availability of fire-wood of local origin. The elaborate drainage-system in the city presupposes a heavy rainfall at least for a few months in the year. The remains of animals such as the tiger, rhinoceros and elephant indicate the existence of a moist tropical forest somewhere nearby. Furthermore, the motifs

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[1] For the distribution of elm, see below, p. 16.

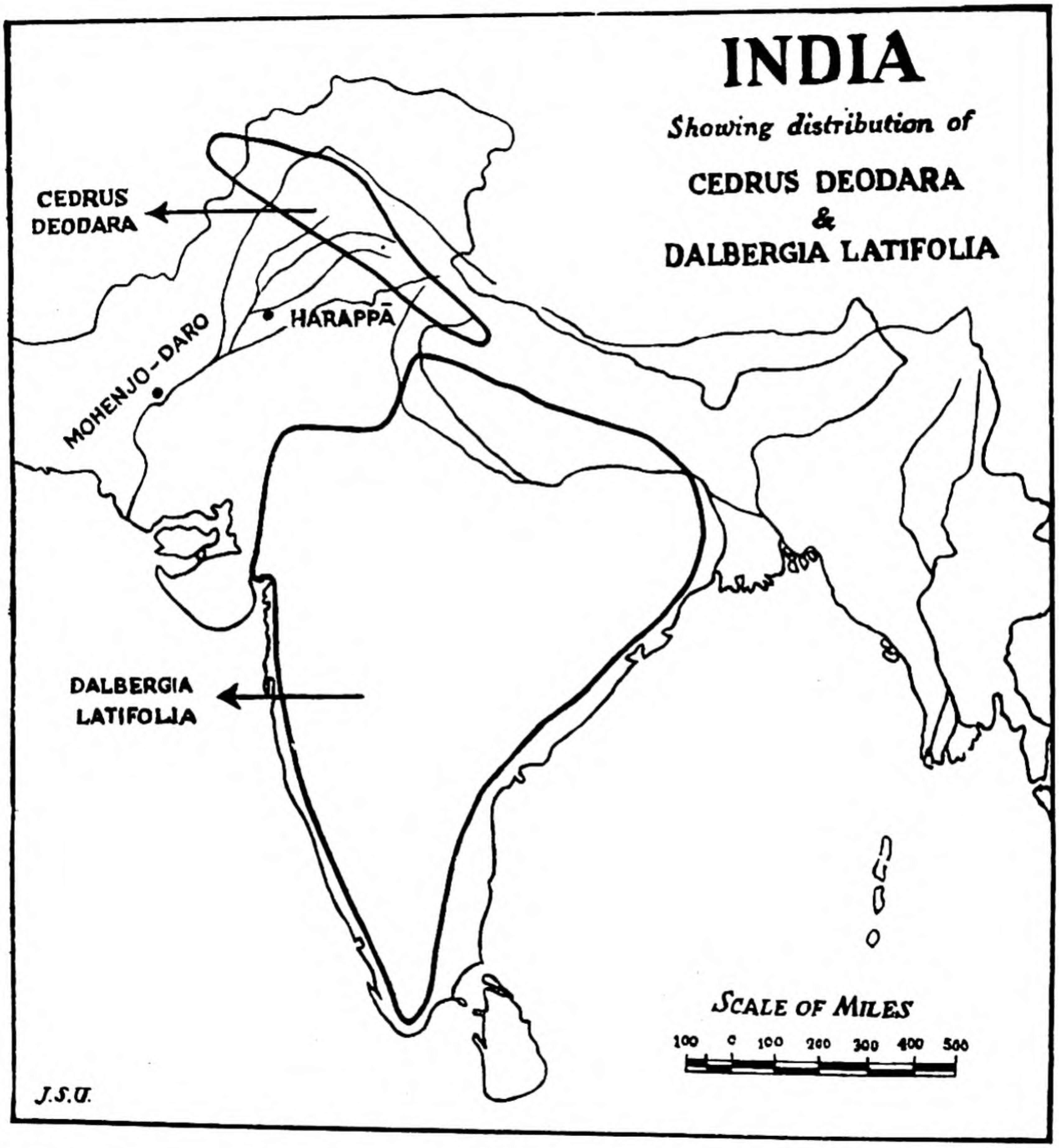
INDIA
Showing distribution of
CEDRUS DEODARA
&
DALBERGIA LATIFOLIA
CEDRUS DEODARA
HARAPPĀ
MOHENJO-DARO
DALBERGIA LATIFOLIA
SCALE OF MILES
100 0 100 200 300 400 500
J.S.U.

FIG. 12

GIRLS COL
ACC. NO.
LIBRARY

of pottery-painting show an acquaintance with the trees and plants of a moist climate. These are, however, all indirect evidences. Now let us see what direct light the present study throws on the problem of climatic changes.

Rosewood.—It now grows in the north in Oudh (Uttar Pradesh) and Mārwāra (Rajasthan), extending to the west up to Panchmahals of Bombay State (fig. 12). The distance between Harappā and the nearest locality where rosewood grows now is not more than 350 miles. It is not unlikely that four thousand years ago rosewood was growing near about Harappā[1] and that with the formation of desert conditions it has migrated southwards. Another alternative that suggests itself is that we may still be ignorant of the southern boundary of the Harappā culture, for there might have been settlements further south with which the Harappans had contacts. In that case the people of Harappā could have obtained rosewood from the southern settlements.

Deodar.—The present distribution of deodar is confined to the hills. It grows in Afghanistan and western Himalaya extending up to Nepal (fig. 12). It is usually found at an elevation of 6,500 ft. to 12,000 ft. above sea-level. The source of supply of this timber for Harappā seems to be from the hills of northern India—a distance of over 500 miles. Can it be possible that deodar trees grew at that time at a much lower elevation than they do now ? This possibility has, however, to be ruled out as the distribution of deodar could not have been very different at that time from what it is now, in view of the fact that the effects of the last glaciation were over long before the Harappā culture.

The next point is, how this timber was brought down to Harappā. Archaeologists have located many centres of the Harappā culture,[2] some of which were situated at the foot of the hills. In addition to this, the presence of *silajit*[3] and 'the horns at least of the Kashmir, spotted, Sambhur and hog deer'[4] amongst the finds at Harappā provides indirect evidence of communication with the hills. All these data provide sufficient information to visualize how deodar timber came to be used in the plains of the Panjab. Here we cannot think of any other means of transport at that time except the river.

Ber.—The genus *Zizyphus* contains over 60 species, of which, according to Brandis,[5] 14 are available in India. Parker mentions six species growing in the Panjab.[6] We are not sure to which species the timber from Harappā belongs. All that can be said is that the timber was available locally and was used as mortar for pounding grains.

Elm.—The genus *Ulmus* is for the most part confined to the temperate region. Four species are known to grow in India, of which three (*U. wallichiana*, *U. villosa* and *U. parvifolia*) are confined to the western Himalaya and the foot-hills, and the fourth (*U. lancifolia*) is found in the central and eastern Himalaya extending to the south up to Khasi Hills, Chittagong and Burma. The plant remains from Harappā resemble most *U. lancifolia* which has a semi-ring-porous to diffuse-porous timber. On the other hand, the three *Ulmus* species from the western Himalava are prominently ring-porous. Now the question is : how did the people of Harappā obtain this timber ? Three possibilities present themselves. Firstly, *U. lancifolia* grew in the western Himalaya at that time but has changed its distribution and is now confined to the eastern zone. Though such a suggestion might at first appear to be a mere speculation, it can be true in view of what Randhawa has pointed out about the distribution of *Saraca indica* between 2,500-2,000 years ago and now.[1] Secondly, there has been no change in its distribution within the last four thousand years, which would mean a very long lead of transport, for which there is little evidence. Thirdly, a species allied to *U. lancifolia*, having semi-ring-porous to diffuse-porous structure, grew on the western Himalaya but has since been wiped out. There is some support for this view from palaeobotanical record, as an unrecognized species of *Ulmus* has been reported from the Lower Pleistocene Karewa deposits of Kashmir.[2] This report is based on leaf-impression and does not say whether the timber was ring-porous or semi-ring-porous. Further information on all the three points will be necessary before we can say which view is correct.

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[1] M. S. Vats, *Excavations at Harappā* (Calcutta, 1940), p. 468.

[2] Stuart Piggott, *Prehistoric India* (London, 1950), p. 136.

[3] *Ibid.*, p. 175.

[4] *Ibid.*, p. 135.

[5] D. Brandis, *Indian Trees* (London, 1921).

[6] R. N. Parker, *A Forest Flora for the Punjab* (Lahore, 1918).

The light that the plant-remains of Harappā throw on the climate and the vegetation of the place may now be summarized here. Out of the four wood remains, two, viz. deodar and elm, were from the hills and could not have grown near about Harappā and must have been obtained from some distance. The other two, i.e., rosewood and ber, were either local trees or brought from a neighbouring forest. These wood remains do not support the theory that a moist tropical forest prevailed in the neighbourhood of Harappā. Keeping in view the fact that Harappā was a capital of a highly civilized state, a luxuriant forest in the neighbourhood would mean many more uses of the forest-produce than has so far been recorded. Furthermore, previous reports show that even for house-building timbers like pine[3] and deodar[4] were obtained from considerable distances. From these and other evidences we visualize a vegetation of scrub forest with tall grass and pockets of marshy land at or near Harappā. The rainfall must have been heavy for a few months in the year.

6. SUMMARY

1. Some plant-remains from the excavation at Harappā in 1946 have been studied and are reported here. They have yielded four commercial timbers.

2. For the coffin, two timbers were used, viz. *Dalbergia latifolia* (rosewood) for the side-walls and *Cedrus* sp., probably *C. deodara* (deodar, cedar), for the top-planks. The wood remains from the depression of a circular platform are *Zizyphus* sp. (ber). Remains from the top of the same platform are wood of *Ulmus* sp. (elm).

3. The archaeological significance of these finds is discussed in some details, especially with reference to the ancient Indian, Mesopotamian and Egyptian civilizations. The remarkable similarity in the use of timbers for the coffin at Harappā and those of ancient Mesopotamia and Egypt is interesting. The use of scented timbers in both the cases may be of some significance. The earlier report on the presence of a reed-shroud over the coffin has not been confirmed, and it appears that there was a deodar cover over the upper part of the body. Some additional proof for the contacts between the Indus valley and Sumer is thus established.

4. Of the four timber remains, two are of local origin and the other two are from hills. Use of hill-timbers indicates, firstly, trade-connection of the people of Harappā

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[1] M. S. Randhawa, 'Progressive desiccation of northern India in historical times', *Journal of the Bombay Natural History Society*, 45 (1945), pp. 558-65.

[2] G. S. Puri, 'Some fossil leaves of the *Ulmaceae* from the Karewa deposits of Kashmir', *Journ. Indian Bot. Soc.*, XXIV, no. 4 (1945), pp. 186-87.

[3] M. S. Vats, *Excavations at Harappā* (Calcutta, 1940), p. 162.

[4] Piggott, *op. cit.*, p. 135.

with those of the hills and, secondly, insufficiency of suitable local timbers. All botanical evidences lead one to think that, four thousand years ago, near about Harappā there was a scrubby forest with pockets of marshy land and tall grasses, where rainfall was limited to a few months in the year.

7. ACKNOWLEDGEMENT

We are grateful to the Director General of Archaeology in India for giving us an opportunity of studying these plant remains. Acknowledgements are also due to the authorities of the British Museum, London, for library facilities, and to Dr. F. N. Howes, Keeper of Museum, Royal Botanic Gardens, Kew, England, for allowing one of us (K.A.C.) to examine Boodle's collection of ancient plant materials from Egypt.

EXPLANATION OF PLATES

Pl. I

Dalbergia latifolia Roxb (no. HP XXIX-128)

1. A photograph of the mark in coffin-wall. Natural size.

2. Transverse section showing the general structure of the wood. Note the distribution of vessels and parenchyma cells, and the shape of the fibres (× 250).

3. A tangential view of the wood. Note size and shape of the rays and the ripple-marks (× 110)

Cedrus deodara Loudon (no. HP XXIX-129)

4. A photograph of the mark of shroud (?). Natural size.

5. Transverse section showing the general structure of the wood (× 90).

Pl. II

Cedrus deodara Loudon (no. HP XXIX-129)

1 and 2. Transverse sections of the wood showing tracheids and rays. (× 110).

3. Tangential section showing uniseriate rays. Note their height and the shape of individual cells. (× 110).

4. Tangential section showing a fusiform ray with horizontal gum duct. Also note the vertical parenchyma cells. (× 110).

Pl. III

Cedrus deodara Loudon (no. HP XXIX-129)

1. Radial section showing marginal cells of the rays. Note the pitting. (× 110).

2. Radial section showing cross-field pitting. (× 400).

3. Radial section showing pits on the radial walls of tracheids. Note scalloped margin of the tori. (× 450).

4. Radial section showing penetration of fungal hyphae. (× 110).

5. Radial wall of a tracheid showing crassulae. (× 200).

Pl. IV

Zizyphus sp. (no. HP XLIV-1)

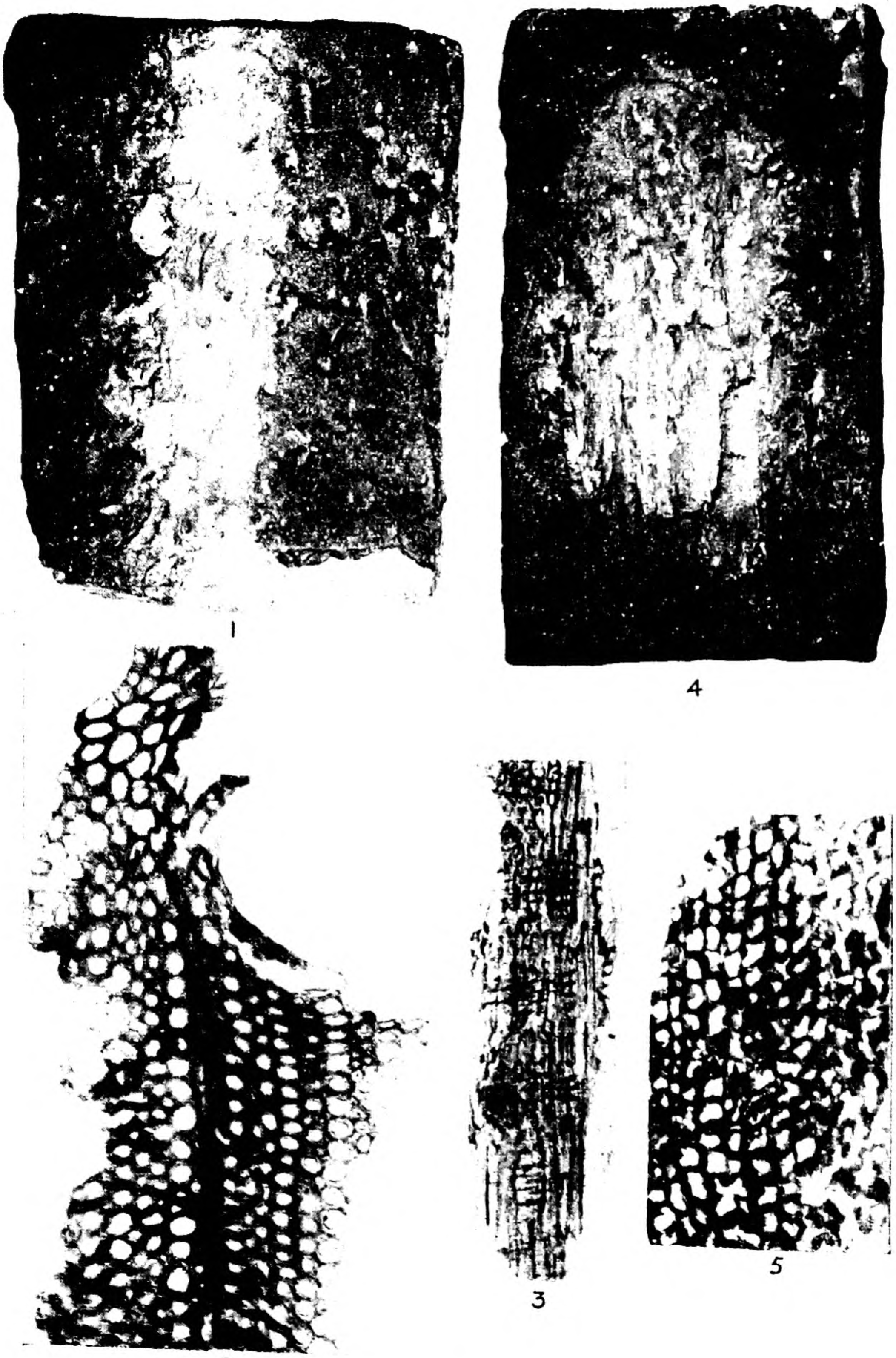
1. Transverse section showing the general structure of the wood. Note the arrangement of the vessels, paratracheal parenchyma and semi-libriform fibres. (× 110).

2. Tangential section showing distribution of uniseriate rays and non-septate fibres. Note crystals in the ray cells. (× 110).

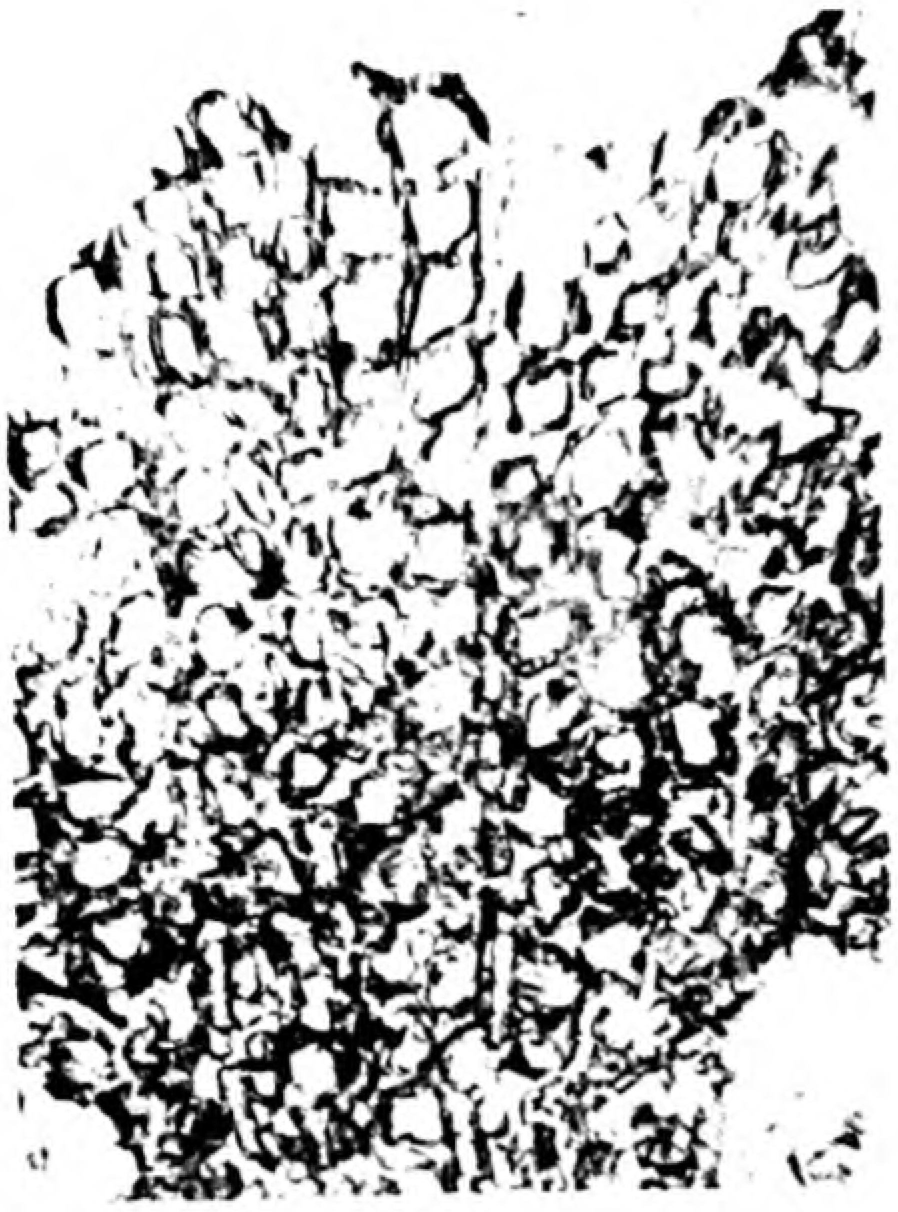
3. Tangential section. Note large, alternate intervessel pits on the right hand side. (× 200).

To face page 18

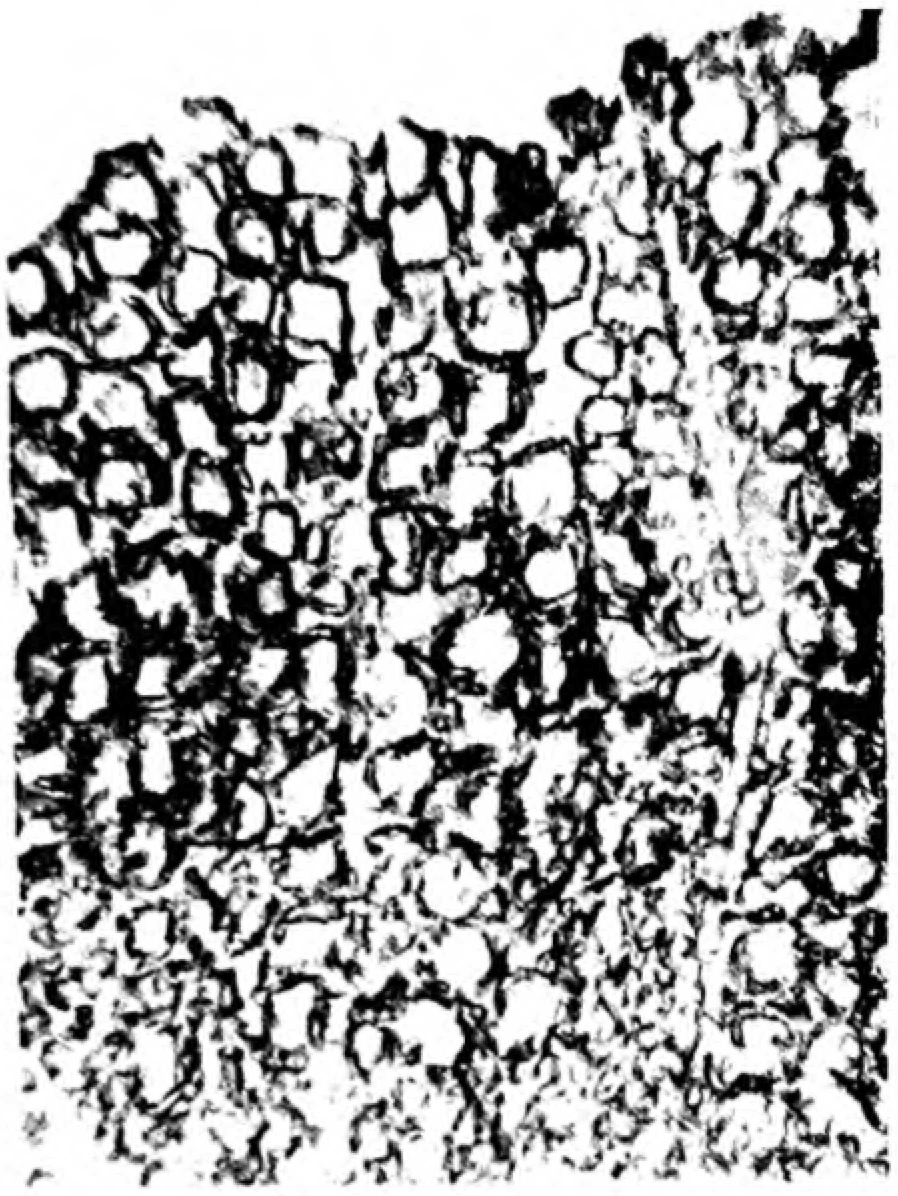
PLATE I



1–3, Dalbergia latifolia: 4–5, Cedrus deodara *(see page 18)*



1



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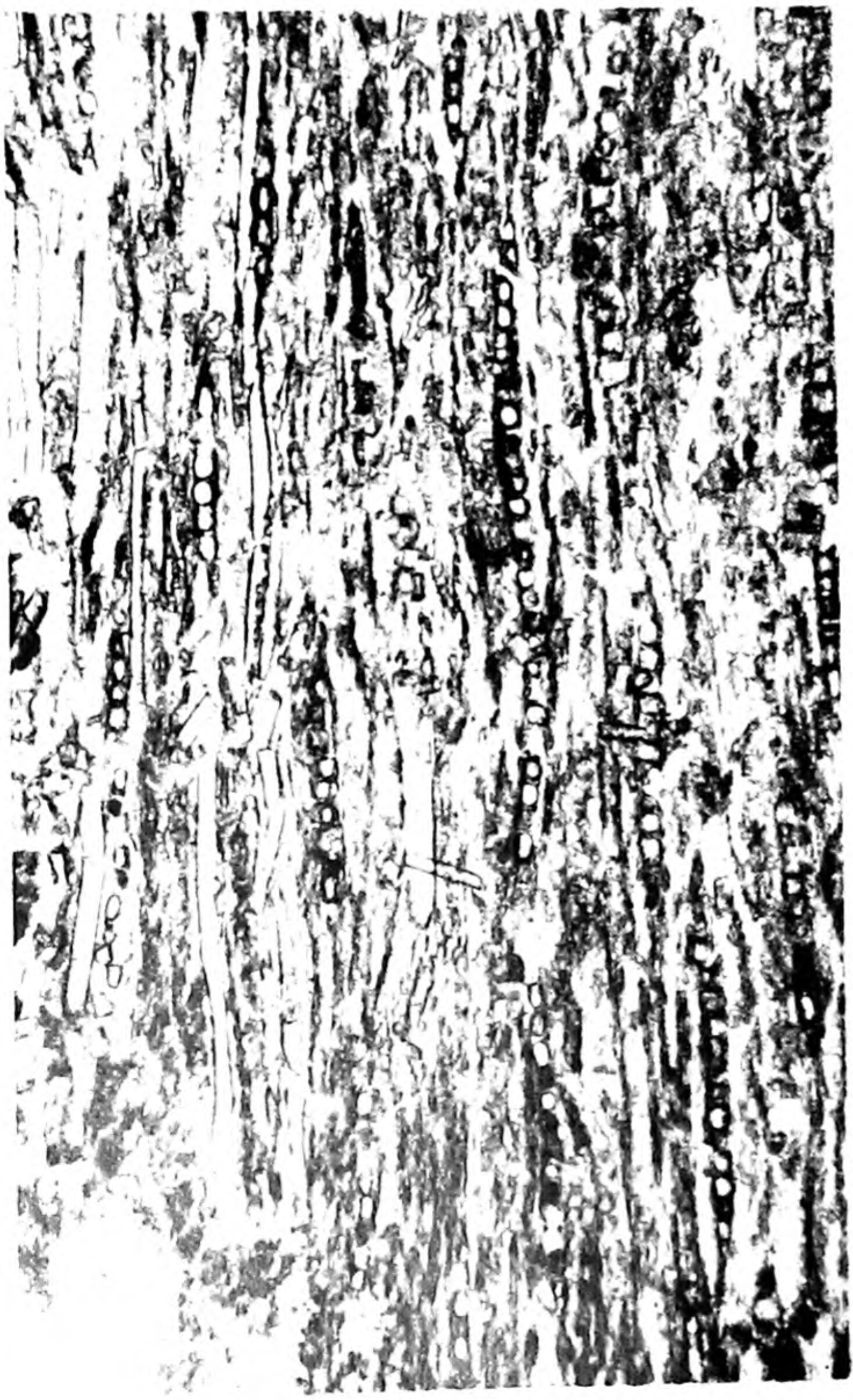
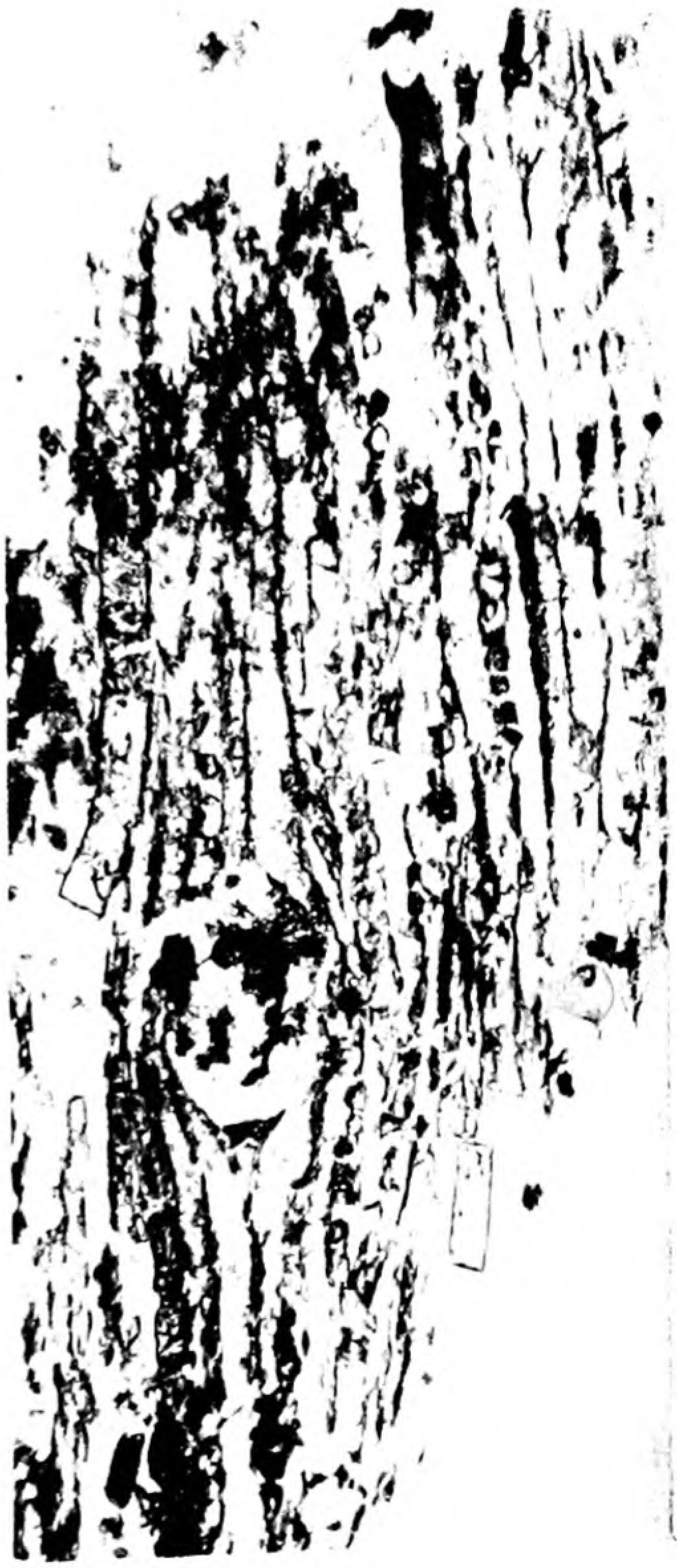


3



4

Cedrus deodara *(see page 18)*

To face plate II

PLATE III

1

2

3

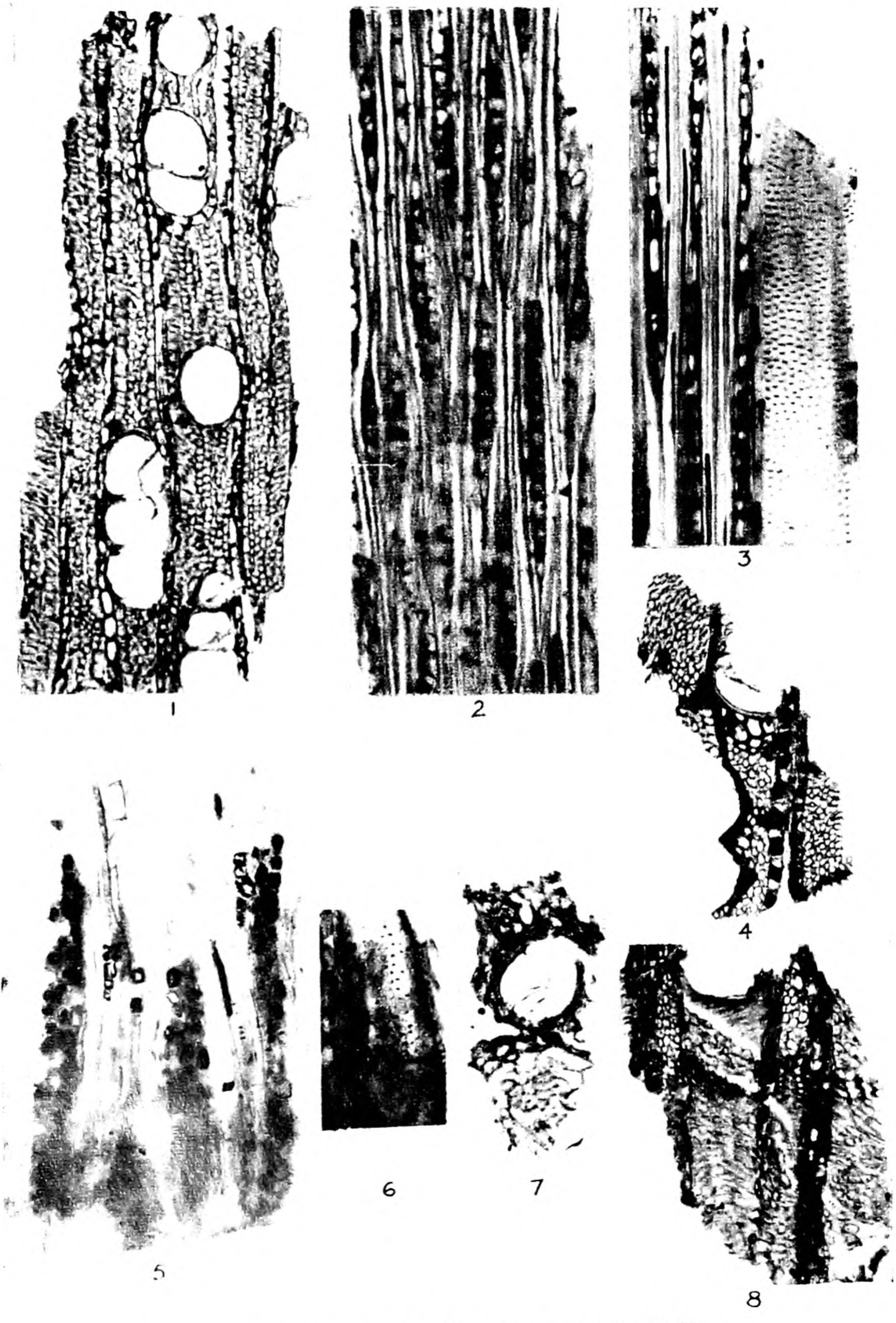
4

5

Cedrus deodara *(see page* 18*)*

PLATE IV

To face page 19



1-3, Zizyphus *sp.*; 4-8, Ulmus *sp.* (*see pages* 18-19)

Ulmus sp. (no. HP XLIV-2)

4. Transverse section showing vessels in part, paratracheal parenchyma, rays and fibres. Note crystals in rays. (× 110).

5. Tangential section showing shape and size of the rays. Note large and oval ray cells often containing deposits. (× 110).

6. Tangential section showing part of vessel with inter-vessel pits. (× 110).

7. Portion of transverse section. Note size and shape of a vessel. (× 110).

8. Another portion of transverse section. Note band of initial parenchyma cells in the middle on the right hand top portion ; shape and size of the fibres are distinctly visible. (× 110).

FURTHER COPPER HOARDS FROM THE GANGETIC BASIN AND A REVIEW OF THE PROBLEM.

By B. B. LAL

The hoards of copper implements discovered in the Gangetic valley from time to time have remained somewhat enigmatic till now, as it has not yet been possible definitely to affiliate them to any one of the known cultures. In this article the Superintendent of the Excavations Branch, besides bringing to notice some implements unrecorded so far, draws attention to a class of pottery which is found associated with the implements and discusses its implication on the authorship of the copper hoards.

1. INTRODUCTORY

MUCH water has flown down the Ganges since Vincent Smith published in 1905 a comprehensive survey of the 'copper hoards' discovered from time to time (the first one going back to 1822) in Uttar Pradesh, Bihar, West Bengal and Madhya Pradesh.[1] He supplemented this survey in 1907 by bringing to light some more material from Biṭhūr and Pariar, both situated in the first-named State.[2] In 1915, Hiranand Shastri published some more implements, including an antennae sword, from Biṭhūr and also some from Bulandshahar and Hardoi Districts of the same State.[3] The same year Coggin Brown brought to light several implements from the Rānchi District of Bihar.[4] In the following year, 1916, A. Campbell and S. C. Roy recorded a large number of axes and bar-celts from Mānbhūm and Pālāmau Districts of the same State.[5] To these were added in the same year three double-edged axes from Mayūrbhanj (Orissa) through the efforts of Cobden Ramsay, the then Political Agent of the area.[6] Since then not many copper hoards seem to have been recorded save for the three antennae swords and a couple of flat celts from Kallūr in Hyderabad.[7] In recent years, however, the study of these objects has gained a fresh momentum, and Professors Stuart Piggott[8] and R. Heine-Geldern[9] have put them on an 'international footing' by citing parallels from beyond the frontiers of India—Hissar and Anau in Persia and Caucasia in south Russia.

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[1] Vincent A. Smith, 'The Copper Age and prehistoric bronze implements of India', *Indian Antiquary*, XXXIV (1905), pp. 229-44.

[2] Vincent A. Smith, 'The Copper Age and prehistoric implements of India—supplement', *Indian Antiquary*, XXXVI (1907), pp. 53-55.

[3] H. Shastri, 'Recent additions to our knowledge of the Copper Age antiquities of the Indian Empire', *Journ. Asiatic Soc. Bengal*, New Series, XI (1915), pp. 1-16.

[4] J. Coggin Brown in *Journ. Bihar and Orissa Res. Soc.*, I (1915) pp. 127-28.

[5] A. Campbell in *Journ. Bihar and Orissa Res.*, *Soc.*, II (1916), pp. 85-86 ; S. C. Roy in *ibid.*, pp. 482-83.

[6] *Ibid.*, pp. 386-87.

[7] *Annual Rep. Arch. Deptt. H.E.H. the Nizum's Dominions for* 1937-40 (Calcutta 1942), pp. 22-24.

[8] Stuart Piggott, 'Prehistoric copper hoards in the Ganges basin', *Antiquity*, no. 72 (1944), pp. 173-182.

[9] R. Heine-Geldern, 'Archaeological traces of the Vedic Aryans', *Journ. Indian Soc. of Oriental Art*, IV (1936), pp. 87-113, and 'New light on the Aryan migration to India', *Bulletin American Institute for Iranian Art and Archaeology*, V (June 1937), pp. 7-16.

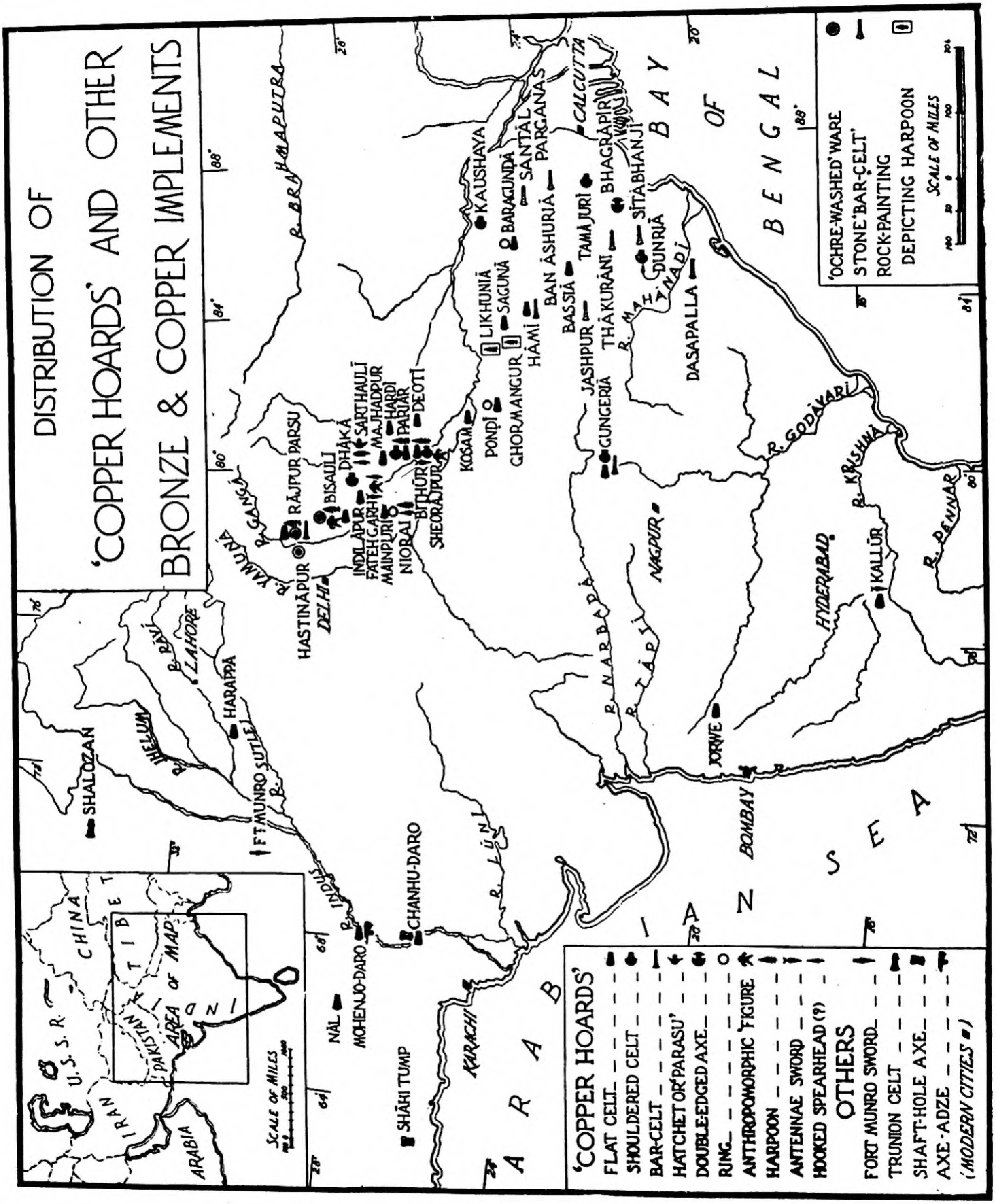
DISTRIBUTION OF 'COPPER HOARDS' AND OTHER BRONZE & COPPER IMPLEMENTS
'COPPER HOARDS'
FLAT CELT
SHOULDERED CELT
BAR-CELT
HATCHET OR 'PARASU'
DOUBLE-EDGED AXE
RING
ANTHROPOMORPHIC FIGURE
HARPOON
ANTENNAE SWORD
HOOKED SPEARHEAD (?)
OTHERS
FORT MUNRO SWORD
TRUNION CELT
SHAFT-HOLE AXE
AXE-ADZE
(MODERN CITIES ■)
'OCHRE-WASHED' WARE
STONE 'BAR-CELT'
ROCK-PAINTING DEPICTING HARPOON
SCALE OF MILES
U.S.S.R.
CHINA
TIBET
IRAN
ARABIA
PAKISTAN
INDIA
AREA OF MAP
SHALOZAN
FT. MUNRO
HARAPPA
LAHORE
R. RAVI
R. JHELUM
R. SUTLEJ
R. INDUS
MOHENJO-DARO
CHANHU-DARO
NAL
SHAHI TUMP
KARACHI
R. LUNI
ARABIAN SEA
BOMBAY
JORWE
R. NARBADA
R. TAPTI
NAGPUR
HYDERABAD
KALLUR
R. KRISHNA
R. PENNAR
R. GODAVARI
DELHI
HASTINAPUR
R. YAMUNA
R. GANGA
RAJPUR PARSU
BISAULI
INDILAPUR
FATEHGARH
MAINPURI
NIORAI
DHAKA
SARTHAULI
MAJHADPUR
HARDI
PARIAR
DEOTI
BITHUR
SHEORAJPUR
KOSAM
PONDI
GHORMANGUR
LIKHUNIA
SAGUNA
HAMI
GUNGERIA
JASHPUR
BASSIA
BAN ASHURIA
THAKURANI
TAMAJURI
KAUSHAYA
BARAGUNDA
SANTAL PARGANAS
BHAGRAPIR
SITABHANJI
DUNRIA
DASAPALLA
R. MAHANADI
CALCUTTA
R. BRAHMAPUTRA
BAY OF BENGAL
28°
24°
20°
16°
64°
68°
72°
76°
80°
84°
88°

FIG. I

The object in writing the present paper is primarily to place before scholars some more (nearly thirtyfive) copper implements which have come to the author's notice in recent years. This would also form an occasion to discuss afresh, as far as possible, the theories enunciated by Piggott and Heine-Geldern.

2. FRESH MATERIAL

The implements described here are lodged in the Municipal Museum, Allahabad, Bhārat Kalā Bhavan, Banaras, and the State Museum, Lucknow. During his visit to these places in September, 1950, the author took an opportunity of examining whatever copper implements were kindly brought to his notice by the authorities concerned.[1] The collections in the Allahabad and Banaras Museums have not been published previously. Those at Lucknow had been recorded up-to-date by Vincent Smith (1905 and 1907) and Hiranand Shastri (1915), and therefore only the specimens acquired by the Museum subsequently have been noticed here.

THE MUNICIPAL MUSEUM, ALLAHABAD

The Museum contains copper implements from three places : (i) Poṇḍī, (ii) Biṭhūr and (iii) Bisaulī (cf. fig. 1).

Poṇḍī

It is a village in the Teonthar Tehsil of Rewā District in Vindhya Pradesh, about 40 miles south of Allahabad and approached by the Allahabad-Rewā road. While a village school was under construction at Poṇḍī, the workmen hit upon fortyseven rings and five celts, apparently of copper. Of these, three rings and one celt were presented to the Municipal Museum, Allahabad, in 1949 by Maulvi Ayaz Ali Khan, Superintendent of Archaeology, Vindhya Pradesh.

The rings vary from 4 to 4½ in. in diameter and have a circular section, ⅜ to ⅝ in. thick (pl. VI B, 1-2 ; fig. 2, 2). They have a 'mouth' or opening, which shows that pieces of required size were cut out of a long metallic rod and subsequently turned into the shape of rings. Had they been cast, one would not expect trimming marks at the edges of the mouth. Further, the fact that the over-all diameter, thickness of the section and weight etc. vary from specimen to specimen also suggests that the rings were individually made and not cast out of a set mould. This point has to be borne in mind while discussing the probable use of these rings. It has been suggested by some that they were used as weights. Now, unless several specimens are found to have an almost identical weight and various groups fit themselves into a graded scheme, there is hardly any justification for making such an assumption. The three specimens examined by the author at Allahabad do not favour such a view. However, a detailed analysis of the fortyseven specimens from Poṇḍī may be useful in answering the question.

According to another view, they were used as 'ring-money'.[2] Obviously, not much can be said on this point in the absence of any concrete evidence. Since the rings do not have any standard weight nor bear any symbol or mark of authority, one wonders if they can be taken as 'money'.

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[1] See 'Acknowledgements', below, p. 37.

[2] Smith, *op. cit.* (1905), p. 238.

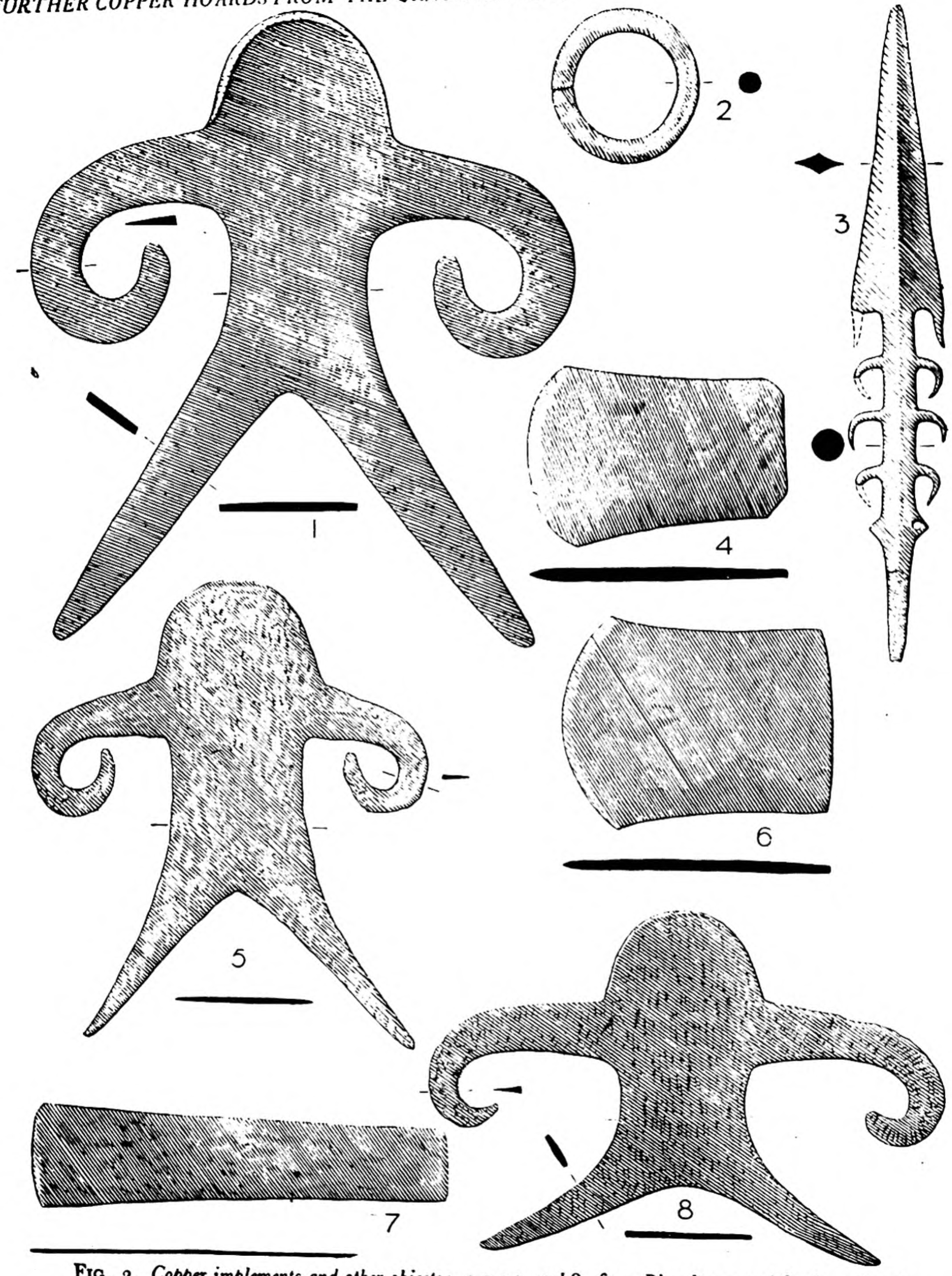

Fig. 2. *Copper implements and other objects:* 1,3,5,7 *and* 8, *from Bisaulī;* 2 *and* 6, *from Ponḍi; and* 4, *from Hardī.* ¼

The celt from Poṇḍī (pl. VI B, 3 ; fig. 2, 6) is of the 'flat' type.[1] It has a square butt, slightly concave sides and a splayed-out cutting-edge. It is 7 in. long, 5½ in. wide and ¼ in. thick and weighs 170 *tolās* (nearly 4½ lbs.).

Biṭhūr

Biṭhūr, situated on the southern bank of the Ganges, 12 miles north-west of Kanpur, has already been known for the occurrence of copper implements (cf. above). The Municipal Museum, Allahabad, purchased from a dealer in 1942 nine copper implements stated to have come from this site. They fall in two groups : (i) flat celts and (ii) shouldered celts. To the former belong nos. 1-4 and 9 of fig. 3. No. 1 has a square butt, slightly concave sides and a somewhat splayed out working-edge. It is over 5½ in. long, nearly 4 in. wide and ¼ in. thick. No. 2 is comparatively longer. No. 3 has a thicker section (nearly 5/12 in.) and appears to have remained unfinished, or, if finished, it is badly worn out and bent. No. 4 is a normal specimen of the type, while no. 9 is stumpy, being only 3½ in. long against a width of 3 in. No. 7 is rather unusual, with its rectangular outline. Its cutting-edge too is not well-pronounced.

In contrast to these flat axes there is one, fig. 3, 5, of the shouldered type. In this case a clear 'shoulder' is formed where the blade joins the sides.

From the map (fig. 1) and the table (p. 38 A) it will be seen that the shouldered type has a more south-easterly distribution. Whether it has any connection with the 'Burmese type' of shouldered celt in stone cannot be said in the present state of our knowledge. It is also probable that the type may have developed from the flat celt (e.g. fig. 3, 4), through intermediary examples having a well splayed-out cutting-edge (e.g. fig. 3, 11).

The two celts not illustrated here belong one each to the flat and shouldered types.

Bisaulī

The Museum contains one 'anthropomorphic' figure from Bisaulī (fig. 2, 5). It belongs to a group of five objects recovered from the site, the other four being at the Bhārat Kalā Bhavan, Banaras (cf. below, p. 25).

The figure measures about 12½ in. in length from 'head' to 'foot', and 11 in. in width from 'arm' to 'arm'. It seems to have been cast and then hammered, the marks left in the latter process being clearly visible all over the body. Both the arms are incurved, and have sharp outer edges. Any use suggested for this figure—religious or utilitarian—cannot but be conjectural.

This object was sent to Dr. B. B. Lal, Archaeological Chemist in India, Dehra Dun, for chemical examination. He reports as follows :—

'A qualitative analysis of the borings from this object shows the presence of copper and nickel only. No other metal is present. The quantitative analysis gave the following results :

Copper	...	98·77	per cent
Nickel	...	0·66	per cent
Total	...	99·43	per cent

'The small amount of nickel detected in the specimen represents only an impurity derived from the copper-ore. The fact is significant, as it shows that the ore from which the metal was smelted was of Indian origin. The Indian copper-ores have generally arsenic or nickel or both as impurities, and these are considered the key-elements in placing the source of the raw material. The nearest copper-mines and ancient copper-workings exist in Rajputana and Singhbhūm, and it is probable that the specimens in question may have been derived from ores from such a source.'

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[1] Nomenclature after S. Pigott in *Antiquity*, no. 72 (1944), p. 174.

The fact that this object is made of copper and not bronze—and the same applies to most of the other objects as well—seems to play an important part in ascertaining the cultural affiliations of these copper hoards (cf. below, p. 37).

THE BHĀRAT KALĀ BHAVAN, BANARAS

In this Museum are lodged four copper objects from Bisaulī, a Tehsil headquarters in the Badaun District of Uttar Pradesh. As in the case of several other copper hoards, here too the discovery was accidental. While tilling his field, a farmer named Angan struck upon five copper objects at a depth of hardly a foot below the surface. He reported the matter to the local authorities, and finally Mr. Braj Bhushan Saran Jetley, then Superintendent of Police of the District, presented them to the Bhārat Kalā Bhavan in 1936-37.

Of the four objects, two are 'anthropomorphic' figures and the rest a harpoon and a celt each. Of the anthropomorphic figures, one is tall, while the other is dwarfish. The former specimen is nearly 17 in. long and has a very prominent ridge outlining the 'head' (pl. VI A; fig. 2, 1). In the case of the latter the length is only 9 in. against a width of 13½ in. (pl. V, 1 ; fig. 2, 8). In both the figures—in fact in all the examples of the type—the curved portion of the arms is thinner than the rest of the body and the outer edges are invariably sharp, which facts suggest that this part of the figure had been expanded by beating. Such an impression is supported by the 'hammer-marks' which follow the curvature of the arm in a radial fashion.

The harpoon, nearly 17 in. in length, is a fine example of the type (pl. V, 2 ; fig. 2, 3). It has a strong medial rib and a long tapering blade. The middle part has three pairs of finely-pointed incurved barbs of cylindrical section. At the junction of the barbed portion and the tang there is a pair of knobs of which one is perforated. The perforation or 'eye' was evidently used for passing a cord through in the process of tying the harpoon on to its shaft. The implement was no doubt cast, although there may have been some subsequent hammering at the blade-end.

The celt is rather longish, having a length of 11½ in. against a maximum width of 2¾ in. (pl. V, 3 ; fig. 2, 7). In section too it is unusually thin, only ⅛ in.

In October 1949 the author visited Bisaulī with a view to examining the site. Through the help of the local authorities he was able to contact Angan, who took him to the place where the objects had been ploughed up. The spot lies on the south-eastern outskirts of the town in the Zamindari of Kishori Lal.[1] There is a tomb to the west of the field and a pond each to its north-east and south-east. Surprising though it may appear, the area is almost flat without any signs of a mound. Still, the author thought it worthwhile to dig a little bit, and accordingly two trenches were laid out, one, called A, very close to the find-spot, and another, B, nearly a hundred yards to the south.

Trench A, 14 ft. long and 8 ft. wide, was carried to a depth of about 3 ft. below the ground-level. Whatever little pottery was obtained came from the top first foot. In trench B, 13 ft. by 7 ft., no sherd was encountered lower than 2½ ft. from the surface.

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[1] Information regarding the ownership of the land was obtained from the local revenue officials.

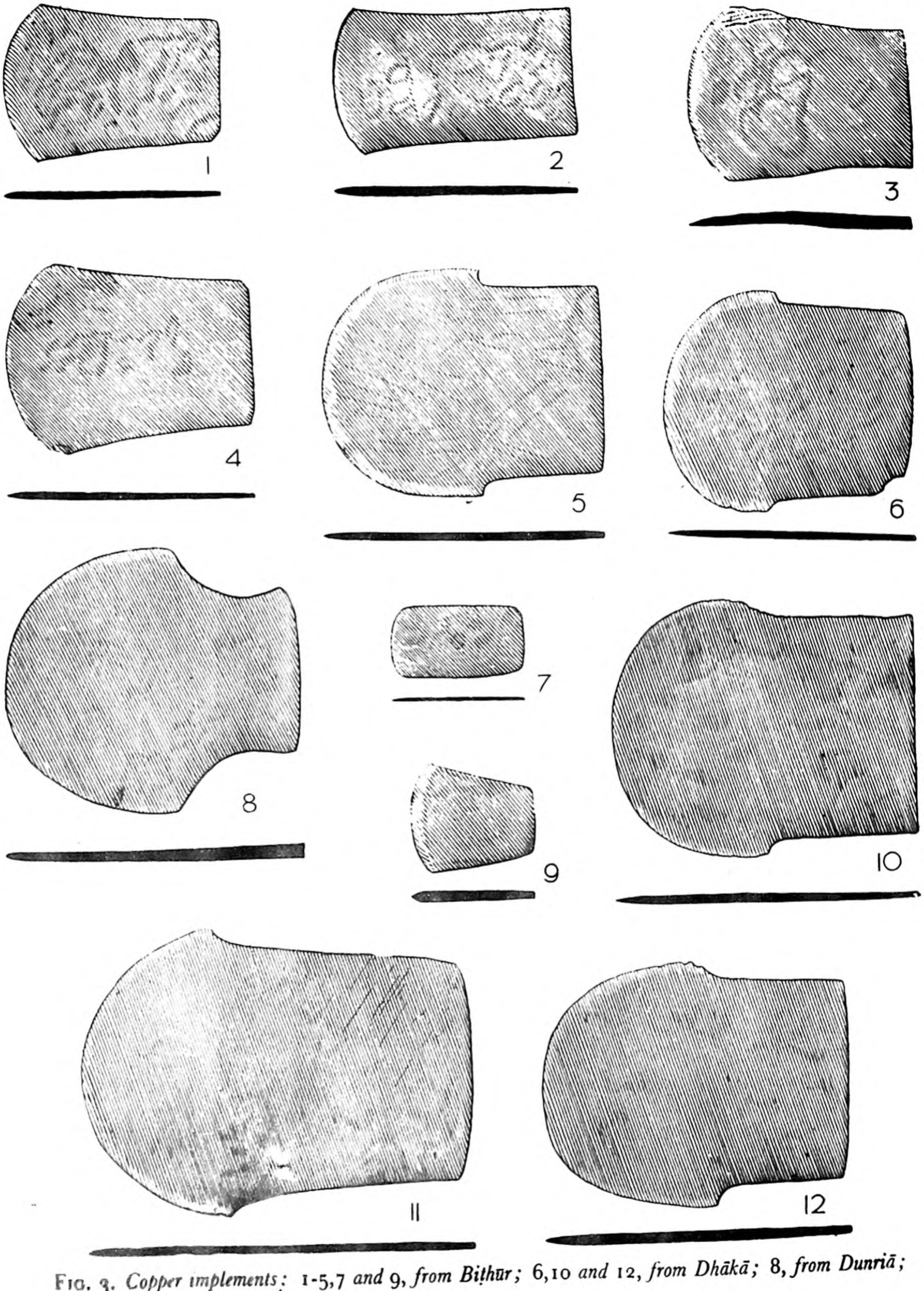
1
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FIG. 3. *Copper implements:* 1-5,7 *and* 9, *from Biṭhūr;* 6,10 *and* 12, *from Dhākā;* 8, *from Dunriā; and* 11, *from Indilāpur.* ¼

The pottery from these trenches, though very limited in quantity, divides itself into two classes : (*a*) well-fired, red-slipped ware with designs executed in black colour and (*b*) ill-fired, thick, ochre-washed ware—mainly bits with worn-out edges. The two varieties were so much mixed up (obviously due to the ploughing up of the field through all these years) that it was difficult to stratify them. However, from the fact that the former type looked fresh and the latter worn out and rolled it is probable (not proved) that the latter was the older of the two.

The excavation did not yield any copper implement (may be that the area dug was not much), and therefore it is very difficult to say which of the two types of pottery mentioned above was associated with the hoard found previously at the site. But if at all any guess is to be hazarded, it is the thick, ochre-washed, rolled ware that would appear to claim contemporaneity with the copper implements. The guess seems to gain ground when viewed alongside similar evidence from another well-known copper-hoard site, Rājpur Parsu, in Bijnor District of Uttar Pradesh (cf. below, p. 37).

THE STATE MUSEUM, LUCKNOW

This Museum has by far the largest number of copper implements and, as stated above, most of them had already been published by Smith and Shastri. Here are described some more objects which have been added to the Museum since 1915.[1] They come from : Hardī, Dhākā, Sarthaulī, Sheorājpur, Indilāpur, Majhadpur and Deotī—all in Uttar Pradesh ; and Dunriā in Pāl Lahārā, Orissa.

Hardī

It is a village in Tehsil Sidhaulī, District Sītāpur, U.P. The Deputy Commissioner, Sītāpur, presented to the Museum in 1924 a celt from this site. The circumstances of the discovery and the exact find-spot are not recorded. The celt is of the flat type, with a square butt and splayed out cutting-edge (fig. 2, 4). It is 6¾ in. long and 4¾ in. wide and has a section nearly ⅓ in. thick. The truncations at the butt-end may perhaps be accidental.

Dhākā

In February 1917, the Museum acquired five celts from village Dhākā, Police Station Tilhar, District Shāhjahānpur, U.P. No other details are recorded.

All the celts belong to the shouldered variety and have a square butt (pl. VII A, 1-5 ; fig. 3, 12, 10 and 6).[2] Plate VII A, 1 (fig. 3, 12) has a length of 8½ in., out of which the blade portion accounts for nearly 5 in. In pl. VII A, 3 (fig. 3, 6) the position is just the reverse, the blade being only 3 in. out of a total length of 7 in. The relative length of the blade and the butt, however, is not of much consequence since the type remains fundamentally the same, there being a pronounced shoulder at the junction of the two portions. The celts are well-made and sturdy. For example, fig. 3, 12 has a thickness of ⅜ in. and weighs nearly 165 *tolās* (well over 4 lbs.).

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[1] In sorting out the post-1915 implements, Shri M. M. Nagar, Curator of the Museum, was of great help to me, for which I am particularly beholden to him. However, there are chances of an oversight, i.e., there may still be some objects in the Museum which, though acquired after 1915, are not recorded here or there may be others which have already been recorded in some obscure publications but are being re-noticed here.

[2] Nos. 4 and 5 of the photograph are not figured.

Sarthaulī

The Museum is in possession of seven implements from Sarthaulī, Pargana Kant, District Shāhjahānpur, presented by the District Magistrate in June 1921. They include: five swords (?), a harpoon and a hatchet or *paraśu*-like object (pls. VIII and VII B ; fig. 4, 1, 3, 5-8).

Pl. VIII, 1 (fig. 4, 5) is the smallest of these swords, being 12¼ in. long. It has a leaf-shaped blade with a stout mid-rib and a small (only 2 in. long), flat tang. In pl. VIII, 2 the blade is much broader, nearly 3 in. The tang, too, is relatively longer, accounting for one-fourth of the total length (15¾ in.) of the sword, and has a forked projection on one side. Pl. VIII, 3 (fig. 4, 1) is the longest of the lot, being 20½ in. The medial rib produces a fine lozenge-shaped section of the blade. In pl. VIII, 4 (fig. 4, 3) the hook at the tang is broken, but one can clearly notice that it was obtained by forking the tang itself. The hook in pl. VIII, 5 (fig. 4, 7) is slightly curved.

That these implements were used as swords cannot be said with certainty. Sir Walter Elliot Smith, while describing a similar implement in the National Museum of Antiquities, Edinburgh, used the term 'sword'[1] and since then it has been vaguely followed. Vincent Smith, on the other hand, has opined : 'in spite of its length it should be called a spear-head. I possess a Somali spear-head, which is 2½ ft. long without, and 3¼ ft. long with, the socket. The hook on the side of the tang seems to have been intended for fastening the blade to the shaft by a thong.'[2] One has only to look for parallels to be convinced of the argument. The harpoons, which were undoubtedly tied on to a shaft by means of a cord or thong, have two devices for the purpose. In one case there is a hole in one of the knobbed projections at the tang through which the cord was passed (pl. V, 2 ; fig. 2, 3). In another there is a forked projection or hook on one side of the tang around which the cord would be passed in order that the implement may be securely fastened to the shaft (pl. VII B, 2 ; fig. 4, 8). The so-called swords have the latter device (e.g. in pl. VIII, 2, 4 and 5 ; fig. 4, 7) and therefore, it is equally possible that they were used as spear-heads.

Though falling within the general category of harpoons, the Sarthaulī specimen (pl. VII B, 2 ; fig. 4, 8) differs in technical details from the Bisaulī example described above (pl. V, 2 ; fig. 2, 3) ; it would perhaps be worthwhile to call them sub-types A and B respectively. In the former case the blade is not a well-developed entity, being only 3 in. out of a length of over 11 in. for the harpoon, whereas in the latter it accounts for nearly half the total length. Again, the barbs in type A are flat, outward indentations (as in the bone prototypes of Magdalenian V and VI), while in type B they are incurved, and have a circular section which culminates in a fine point. It appears that while type B was cast as it is, type A was perhaps obtained by trimming a plain spear-head of the type illustrated in fig. 4, 5. Such an assumption is borne out by the trimming marks left on the outline of the barbs in type A (cf. pl. VII B, 2).[3]

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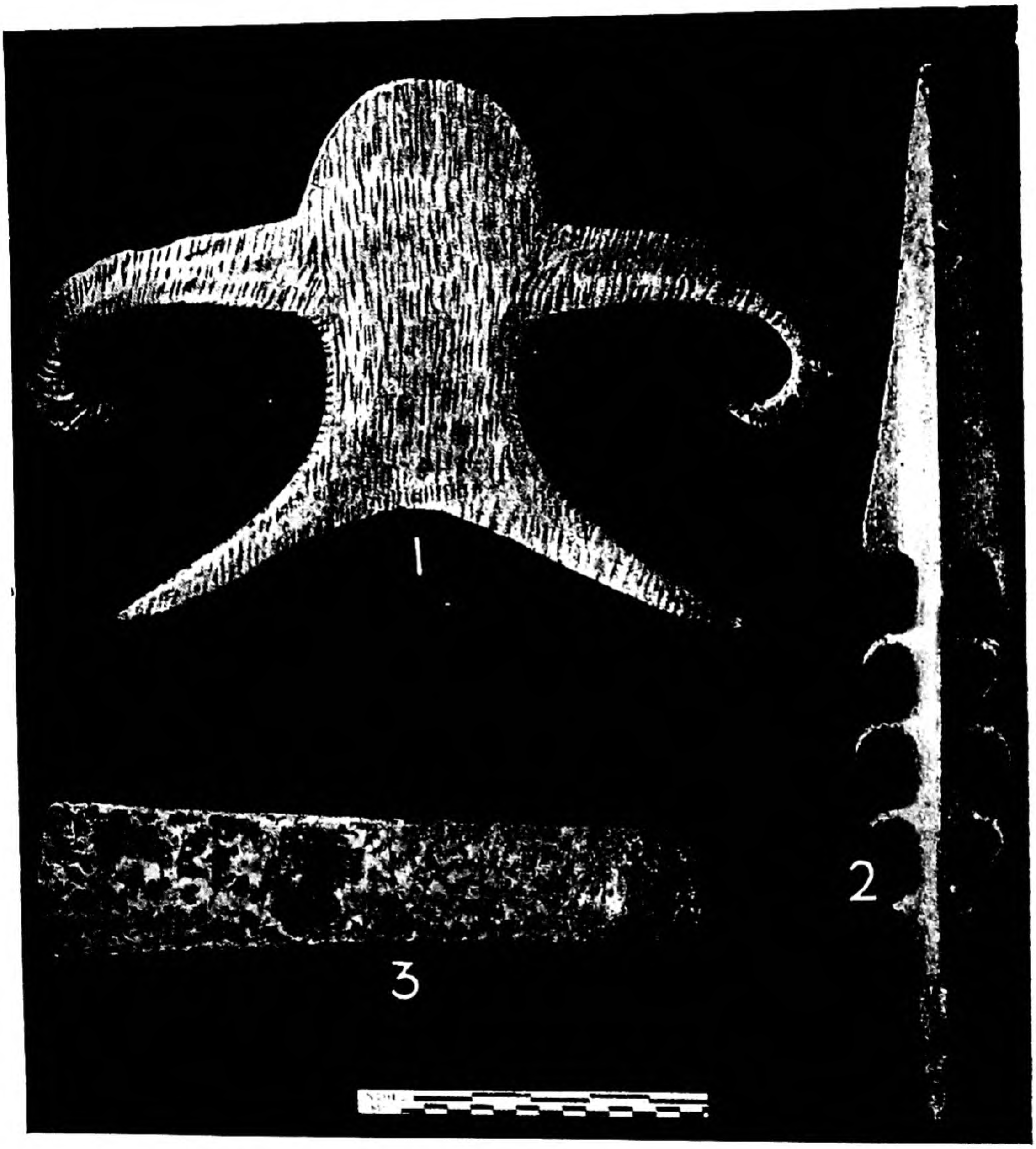
[1] *Proc. Soc. Ant. Scotland*, 1874, p. 691.

[2] V. Smith, *op. cit.* (1905), p. 241.

[3] The harpoon illustrated by Hiranand Shastri in *Journ. Asiatic Soc. Bengal*, XI (1915), pl. III, 1 also confirms this view.

To face page 28

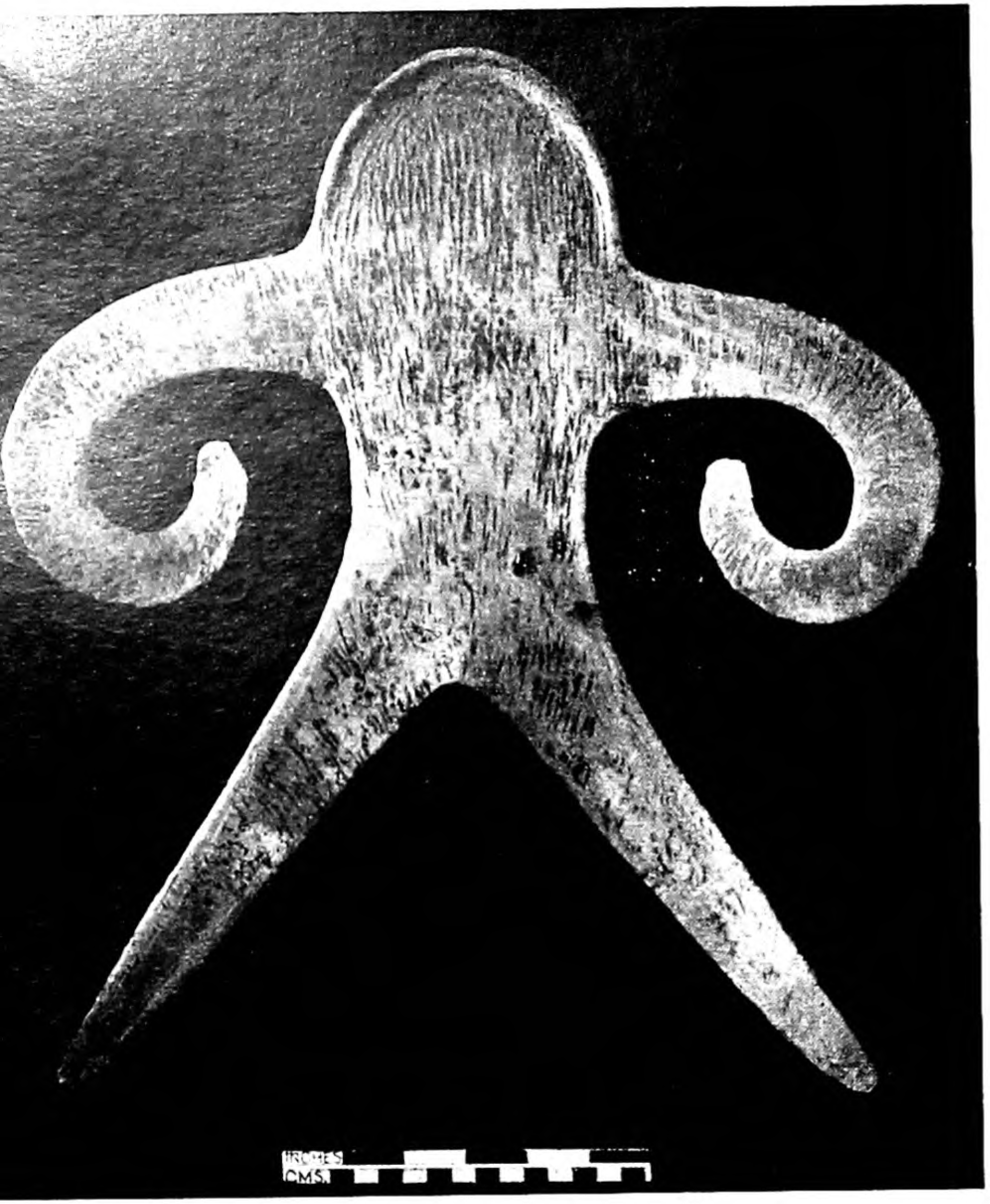
PLATE V



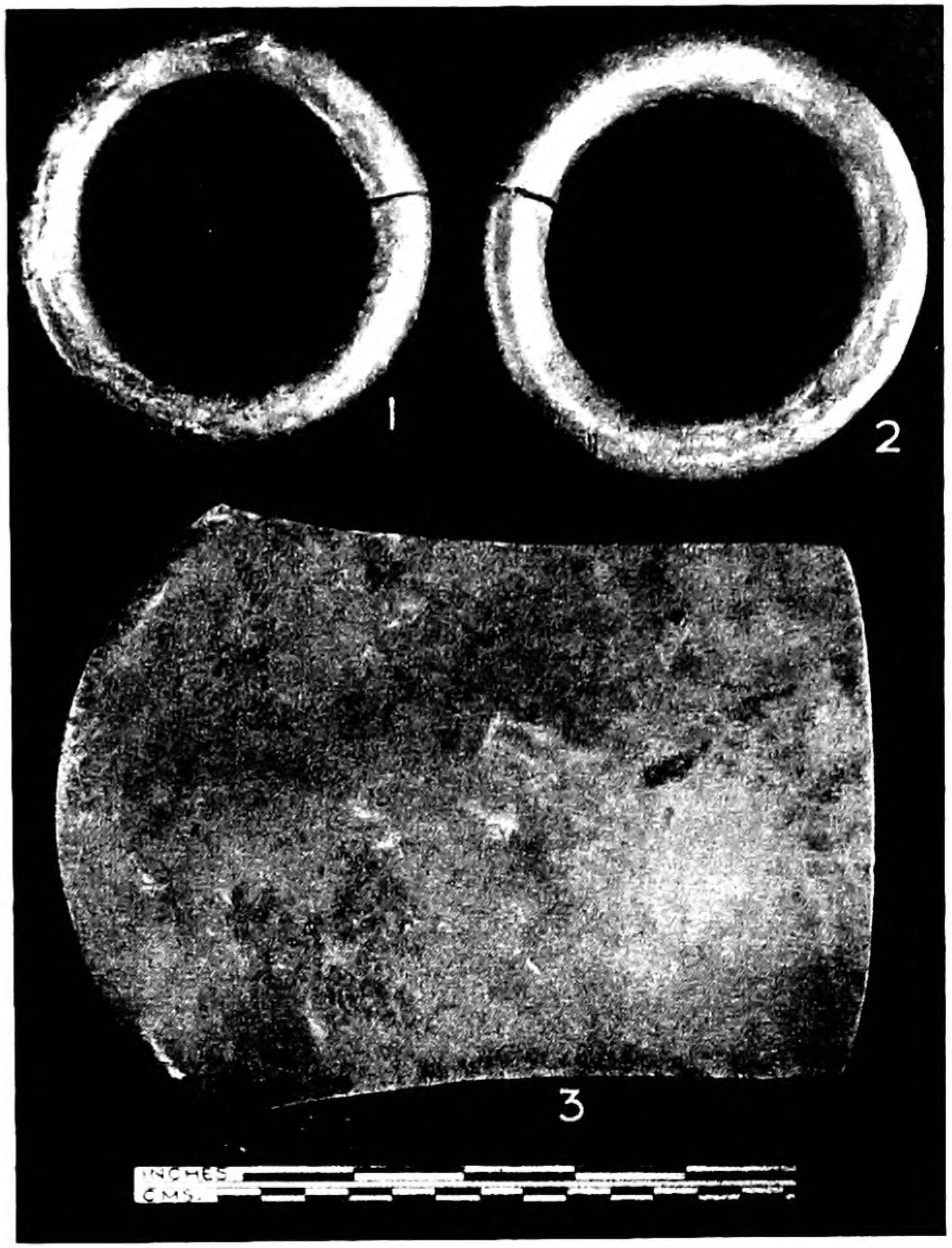
Copper objects from Bisaulī: 1, anthropomorphic figure; 2, harpoon (type B): 3, longish celt see (page 25)

PLATE VI

To face plate VII



A. *Anthropomorphic figure of copper from Bisaulī*
(see page 25)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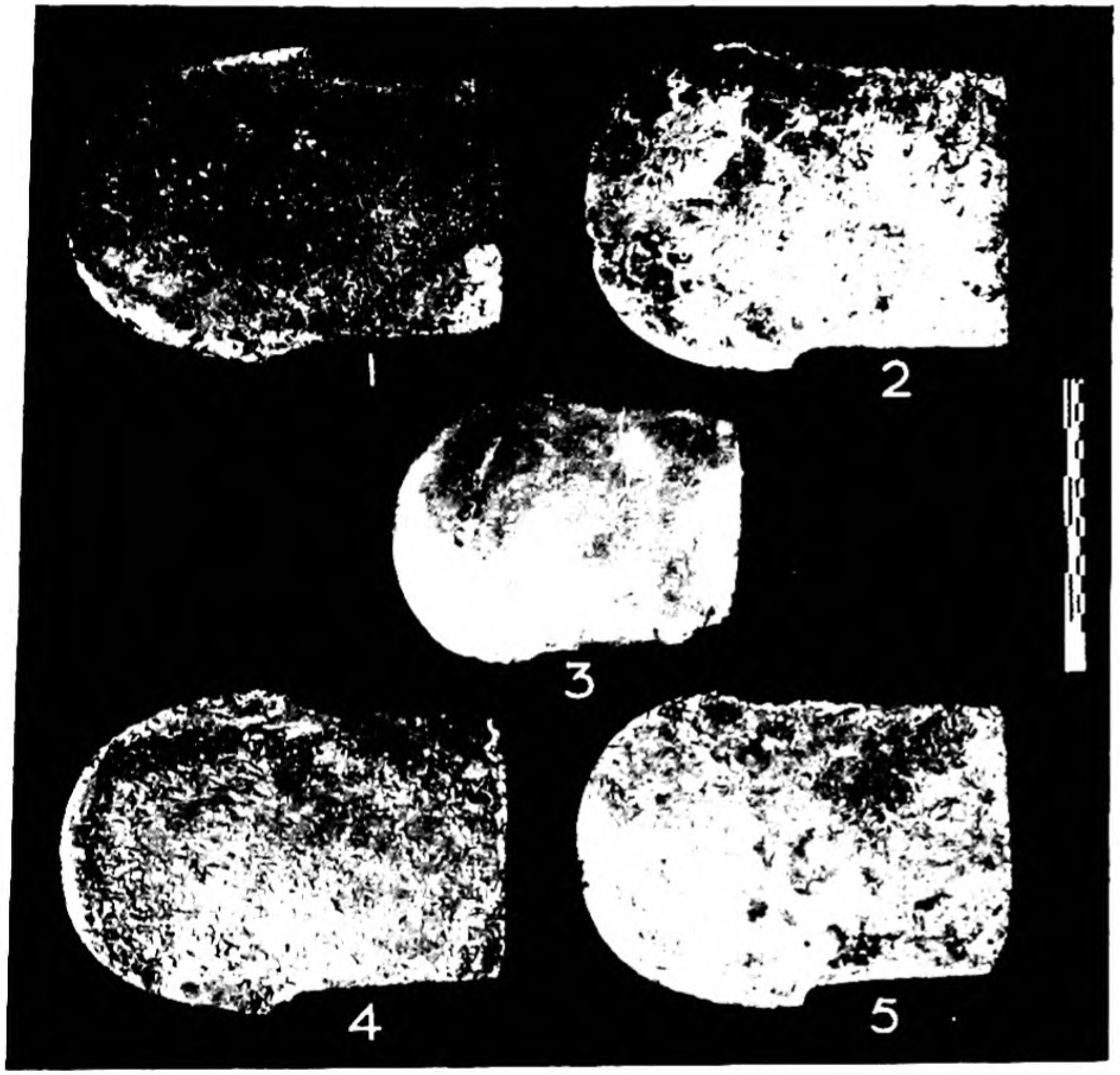
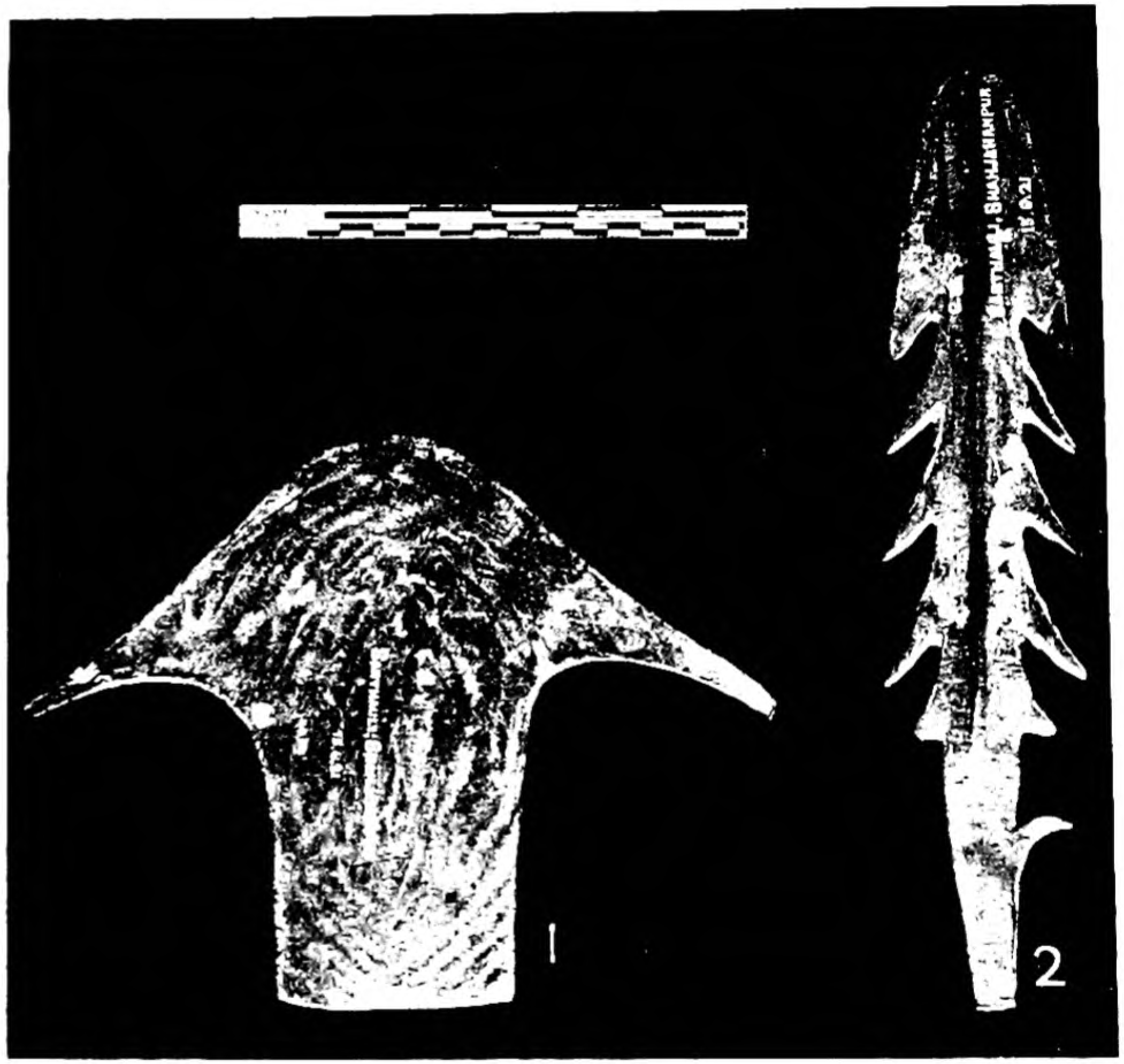
B. *Copper objects from Poṇḍī*: 1 *and* 2, *rings*: 3, *flat celt*
(see pages 22,24)

To face plate VI

PLATE VII



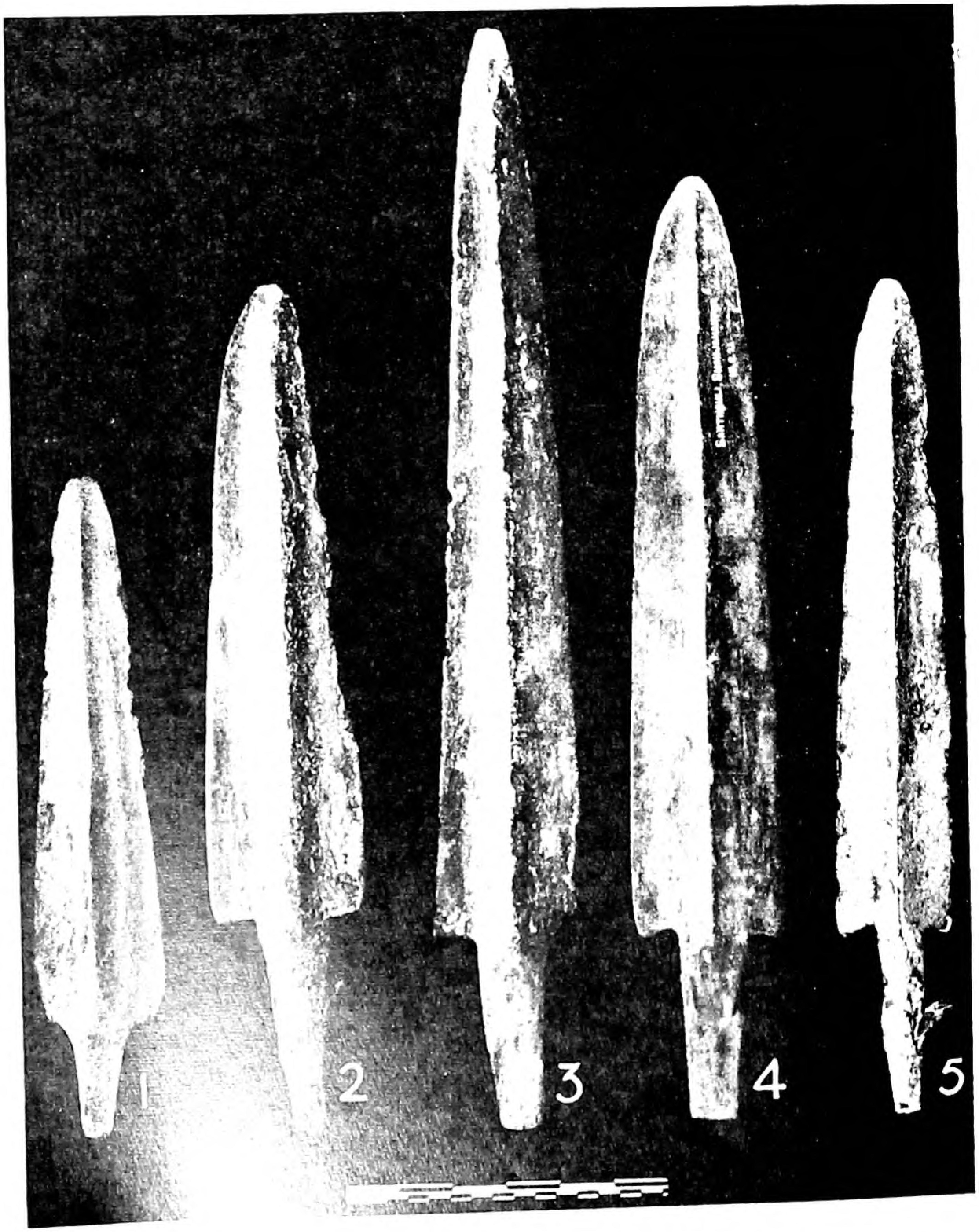
A. *Copper celts from Dhākā.* (*see pages 27–28*)



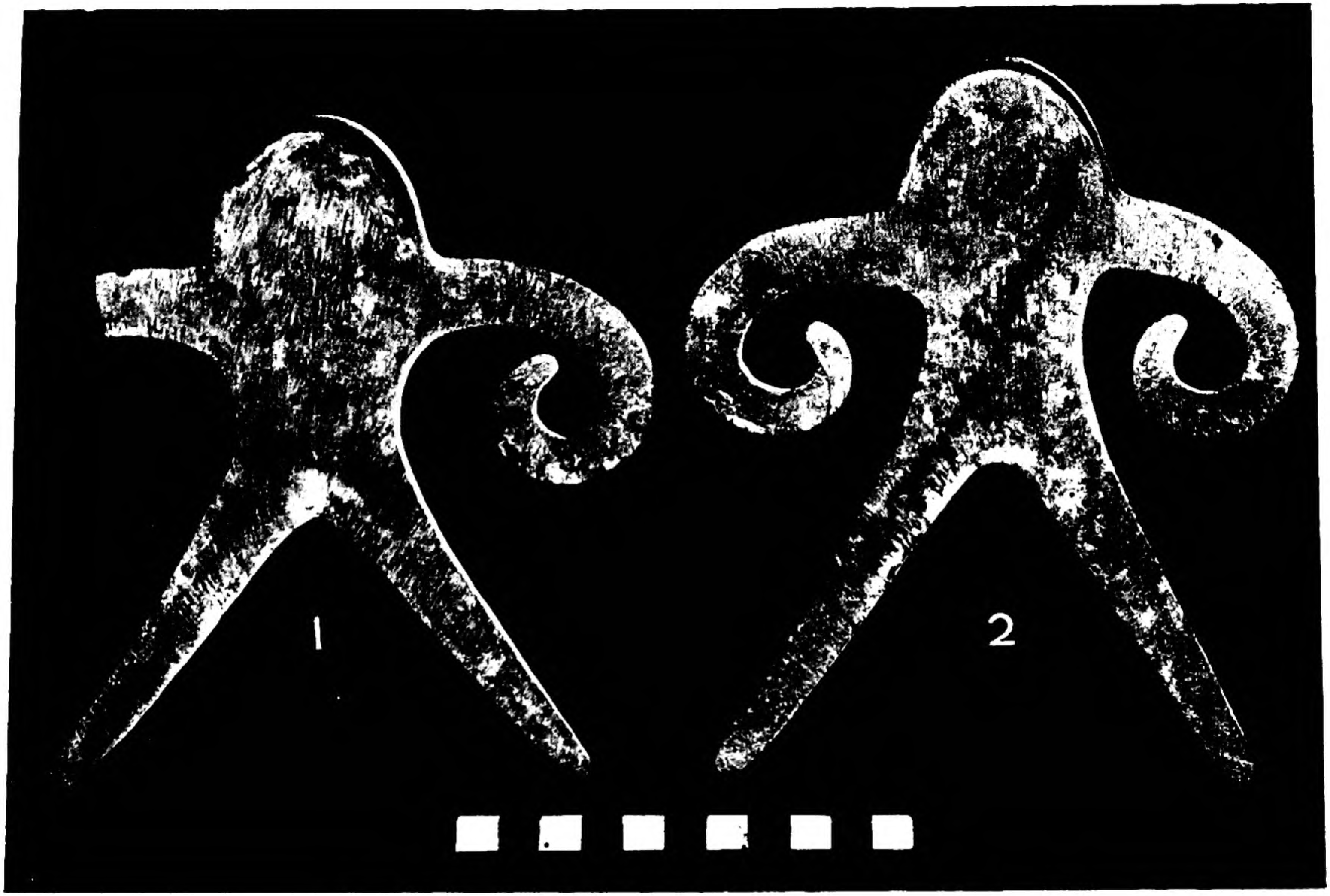
B. 1. *Copper hatchet and 2. harpoon (type A), from Sarthauli*
(*see pages 28–29*)

PLATE VIII

To face plate IX



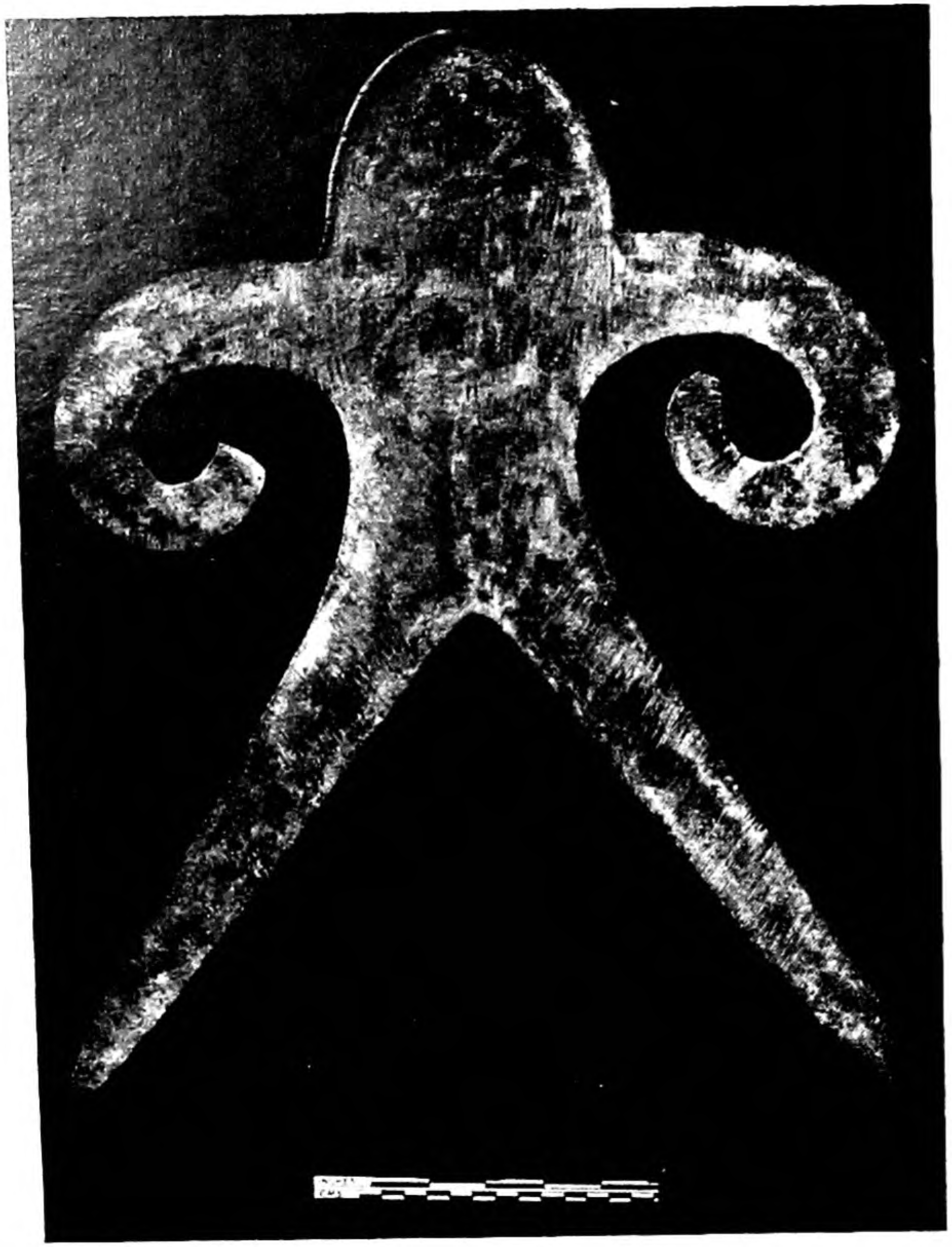
[illegible] heads from Sarthauli (see page 28)



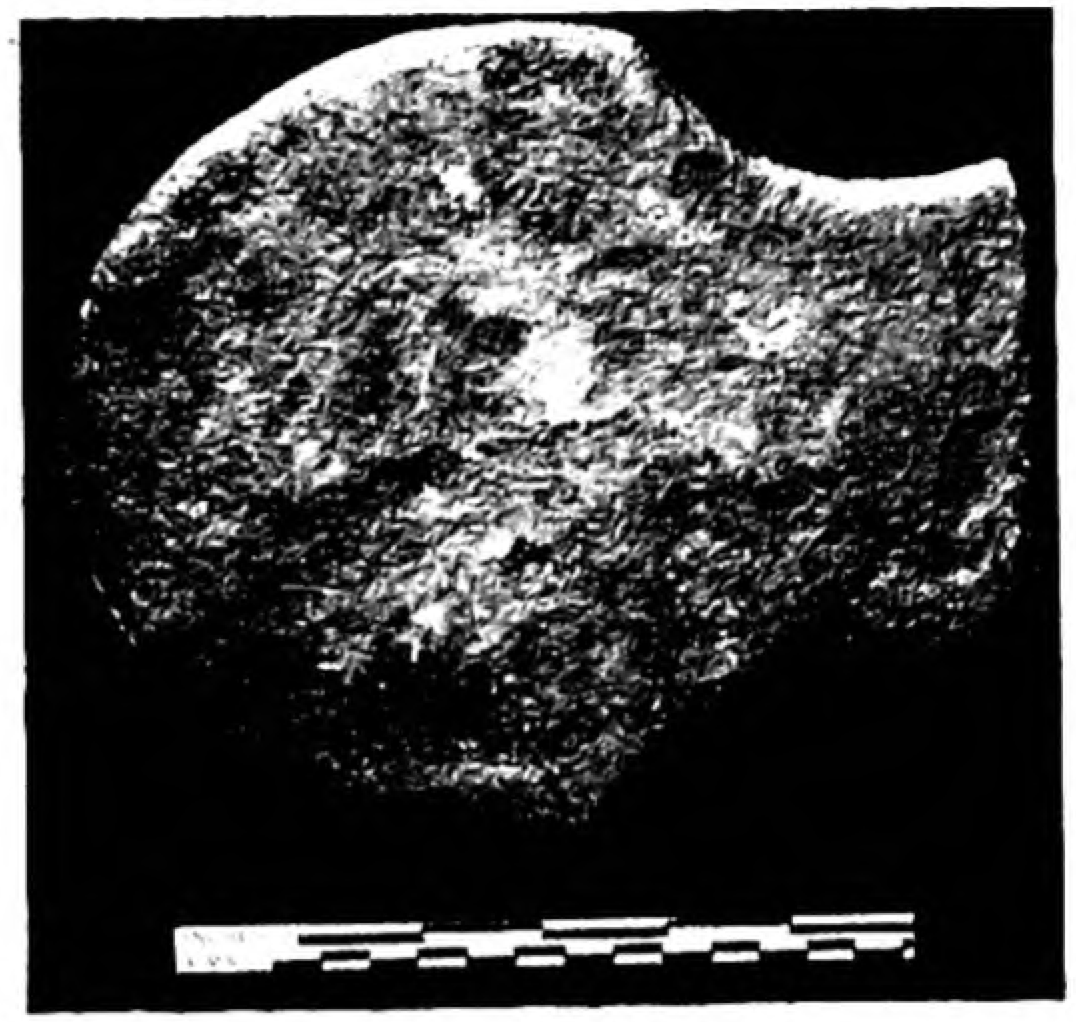
Anthropomorphic figures of copper from Sheorājpur (see page 29)

PLATE X

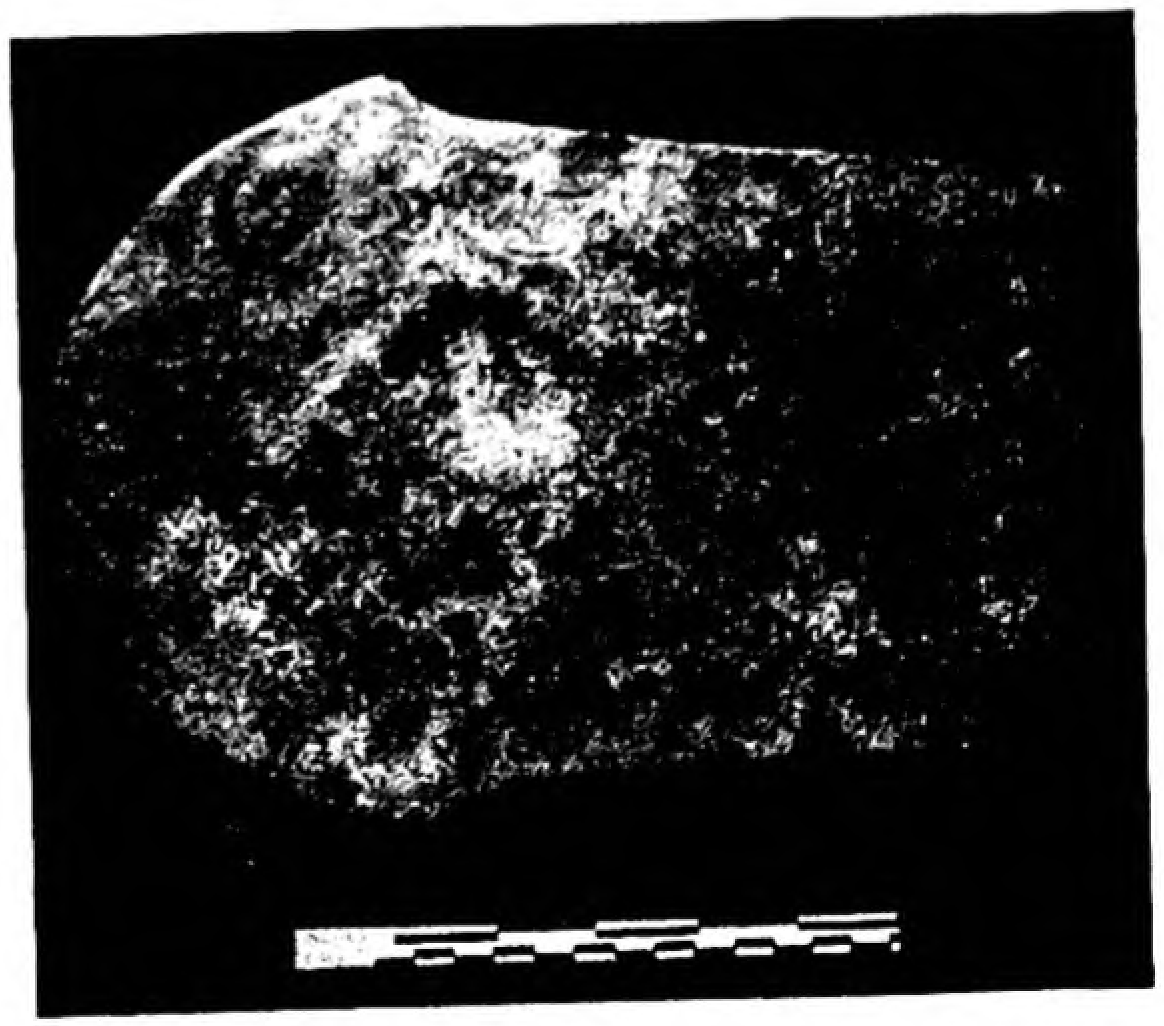
To face page 29



A. *Anthropomorphic figure of copper from Sheorājpur (see page 29)*



B. *Shouldered celt of copper from Dunriā (see page 29)*



C. *Copper celt from Indilāpur (see page 29)*

The hatchet or *paraśu*[1] has a rather unusual shape (pl. VII B, 1 ; fig. 4, 6). It measures 6¾ in. long and nearly 9 in. wide (including the out-stretched 'wings'). The cutting-edge is, however, not very sharp. On its surface are prominent hammer-marks, which incidentally form roughly concentric ovals. Though the implement was cast in the first instance, some trimming also appears to have been done to obtain the final outline of the wings.

Sheorājpur

There are three anthropomorphic figures in the Museum from Sheorājpur, District Kanpur, U.P. (pls. IX and X A). They are indeed massive. The one illustrated in pl. X A measures over 19 in. from head to foot and 12½ in. across and has a well-pronounced ridge round the head. Pl. IX, 2 (fig. 4, 2) is nearly 18 in. long and 15 in. wide and weighs 402 *tolās* (well over 10 lbs.).[2] One of the arms of pl. IX, 1 is broken, but on restoration the figure would measure nearly 16½ in. across.

Indilāpur

It is a village in P. O. Mundiā, District Shāhjahānpur, U.P. The Museum acquired in November 1944 a celt from this site (pl. X C ; fig. 3, 11). It is 10¼ in. long and has a well splayed-out cutting-edge, nearly 7½ in. wide. The blade here begins to develop into a separate entity and thus from the point of view of shape the specimen occupies an intermediary position between the flat and shouldered types of celts (e.g. fig. 3, 4 and 10 respectively).

Majhadpur

In August 1915, the Museum acquired a celt from Majhadpur, P.S. Behtagokul, District Hardoi, U.P. It has a straight cutting-edge, tapering sides and rounded butt (fig. 4, 4).

Deotī

In the Museum is also lodged a fragmentary celt with straight cutting-edge and tapering sides. It was found during the excavation of an irrigation-canal near village Deotī, Tehsil Mohanlālganj, District Lucknow, U.P.

Dunriā

The Museum contains a celt from Dunriā in Pāl Lahārā, Orissa (pl. X B ; fig. 3, 8). It is 7¾ in. long, 6¾ in. wide and nearly ⅜ in. thick at the butt end. The cutting-edge, however, is not sharp. Though of the shouldered type, it differs from other specimens (e.g. fig. 3, 5) in respect of the concavity of the sides.

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[1] Though the shape of this implement does not fully answer the description of a traditional Indian *paraśu*, I have retained the term for the sake of convenience.

[2] The weights mentioned in this paper were very kindly recorded by an assistant of the museum concerned.

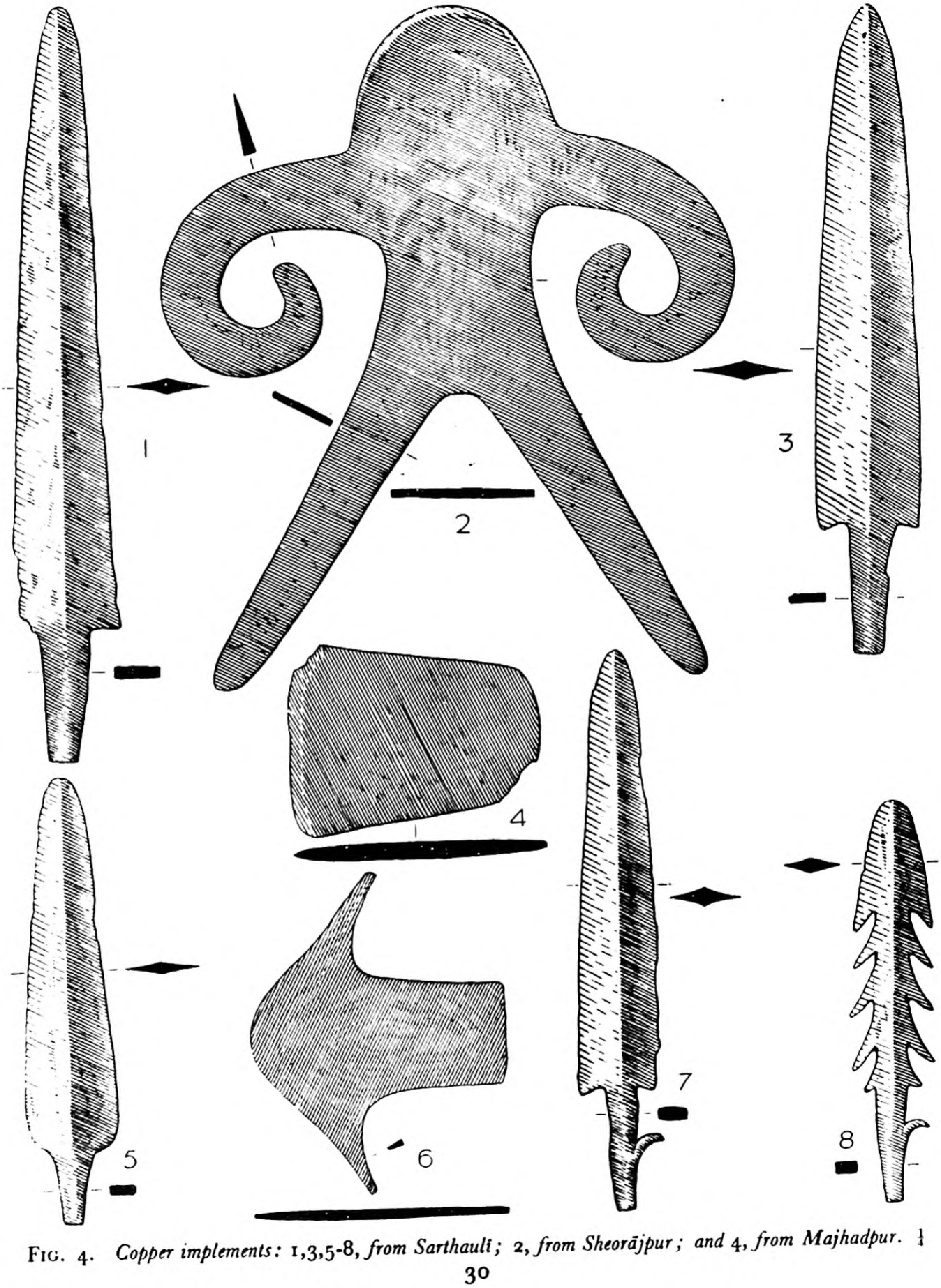

FIG. 4. *Copper implements:* 1,3,5-8, *from Sarthaulī;* 2, *from Sheorājpur;* and 4, *from Majhadpur.* ¼

3. REVIEW OF THE PROBLEM

After this description of the copper implements and their find-spots, one is naturally anxious to know something about their authorship and chronological horizon. Earlier writers like Vincent Smith and Hiranand Shastri did not have much comparative material before them and could not, therefore, dwell on this aspect of the problem. In recent years, however, quite a lot has been said on the subject, specially by two eminent archaeologists, R. Heine-Geldern and Stuart Piggott.

'I beg to be allowed', writes the former, 'to assume for the time being as certainty the hypothesis, that the archaeological finds we discussed, are in fact traces of the Indo-Aryan migration. Now let us see which conclusions we are able to draw from this'.[1] He then concludes: 'Our research has proved with certainty that there must have been cultural intercourse of some kind between northern India on the one hand, and west Persia, Transcaucasia, the Northern Caucasus, and South Russia on the other, during the period from about 1200 to 1000 B.C., and that distinct traces of these connections are to be found in north Persia (Hissar IIIc, Tureng Tepe). Everything else, all interpretation of these finds as traces of a great ethnical migration, their connection with the Vedic Aryans is as yet only hypothetical, though this hypothesis has extremely strong reasons speaking in its favour. We shall only gain certainty by systematic field-work'.[2] Elsewhere he reiterates: 'If we could hope to find some archaeological traces of the Vedic Aryans it would be among these prehistoric copper and bronze objects from northern India'.[3] According to him, therefore, it is the Vedic Aryans who produced these objects, somewhere between 1200 and 1000 B.C.

Professor Piggott too, writing in 1944, made a similar observation. 'If they are, as seems likely, intrusive to the area', he remarked, 'we can hardly avoid the temptation of relating them to some aspect of the Aryan immigration into India. In the search for material evidence of "Vedic" culture these swords, with their implication of warrior invaders, seem perhaps to be the likeliest claimants up to date'.[4] Recently, however, the Professor has modified his views. 'It would be tempting to associate this movement', he observes, 'with something more than trade, and to see in it the colonization of the Ganges basin by refugees and displaced persons from the Punjab and the Indus valley during the time of the break-up of the Harappā empire and the coming of the raiders from the west. The deposition of hoards itself suggests a time of insecurity and economic instability, and may mean that the refugees were not left undisturbed for long, as the invasions gathered momentum and pressed on, beyond the old frontiers of the Harappā kingdom and down into the Ganges valley. But here we leave archaeology for the ambiguous hints of legend and tradition'.[5] According to his latest views, therefore, the copper hoards are to be associated with Harappan refugees and not the Aryans.

In the face of these two stalwarts it is rather embarrassing to re-open the question. The author, therefore, craves their indulgence while placing his view-point before scholars.

Let it be stated at the outset that none of the implements noticed here (or for that matter none of those described by previous writers) has been found in a regular excavation. Nor is there any other evidence (with the exception of that from Bisaulī and Rājpur

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[1] R. Heine-Geldern, *op. cit.* (1936), p. 106.

[2] *Ibid.*, p. 111.

[3] R. Heine-Geldern, *op. cit.* (1937), p. 7.

[4] Stuart Piggott, *op. cit.*, p. 180.

[5] Stuart Piggott, *Prehistoric India* (1950), p. 238.

Parsu discussed in this paper) to ascertain the type of pottery or other objects associated with these hoards. In fact, in several cases it is difficult to locate the exact find-spot even. Thus, no direct or stratigraphical evidence can come to our help in identifying the culture of which these implements formed a constituent or in ascertaining their chronological horizon. Any inference at present, therefore, has necessarily to depend upon stylistic comparisons and other circumstantial evidence.

The ' copper-hoard ' sites of the Gangetic basin have so far produced the following main types of implements : (i) flat celts, (ii) shouldered celts, (iii) bar-celts, (iv) rings, (v) harpoons, (vi) antennae swords and (vii) anthropomorphic figures. Let it now be examined which other sites in India or abroad have produced similar objects.

(*i*) *Flat celts.*—They occur at Harappā and several other protohistoric sites of the Indus valley. Jorwe, 47 miles south-east of Nā[illegible] Bombay State, has yielded four of them.[1] But the type is so simple that not much can be based on its occurrence.

(*ii*) *Shouldered celts.*—As already stated above (p. 24), shouldered celts have a south-easterly distribution, being in the main confined to eastern U.P., Bihar, Bengal and Orissa. No example has so far been found west of the Gangetic basin.

(*iii*) *Bar-celts.*—A bar-celt consists of a nearly parallel-sided bar, the length of which (sometimes up to 2 ft.) measures several times its width. It has a rectangular section, flat bottom and convex upper side (pl. XI B ; fig. 5, 2). The cutting-edge, usually crescentic, is obtained by bevelling the upper side only. The writer has observed that most of these features also characterize the stone celts from the hilly tracts of southern Bihar, western West Bengal and northern Orissa (cf. pl. XI A ; fig. 5, 1).[2] There is, therefore, good reason to believe that the copper bar-celts developed from their prototypes in stone in course of time when metal began to replace stone. It has been suggested by Professor Piggott that the bar-celts may have developed from the narrow elongated celts discovered at Chanhu-daro and Nāl.[3] But these latter specimens do not possess the characteristic features of a bar-celt. Besides, in view of the more positive evidence regarding the evolution of the copper bar-celts from their stone prototypes, as discussed above, the possibility of an Indus valley origin of this type of implement may have to be given up.

(*iv*) *Rings.*—They do not occur at the Indus valley sites. Smith (1905) refers to ' Irish gold ring-money and silver ring-money ', but it is doubtful if the Gangetic specimens of copper have any connection with them.

(*v*) *Harpoons.*—As stated above (p. 28), Magdalenian harpoons of bone have a shape similar to that of our type A (pl. VII B, 2 ; fig. 4, 8). But they are so much removed from the Indian specimens, both in point of time and place, that it is difficult to imagine any relationship between the two. Again, Heine-Geldern has drawn attention to some arrow-heads with simple barbs from Transcaucasia, Talish and Luristan, which, he thinks, may have given rise to the Indian harpoons.[4] This is too much to assume. Barbed arrow-heads are known from several ancient sites in the world, but surely they are quite distinct from the harpoons, the shape and method of hafting of which are fundamentally different.

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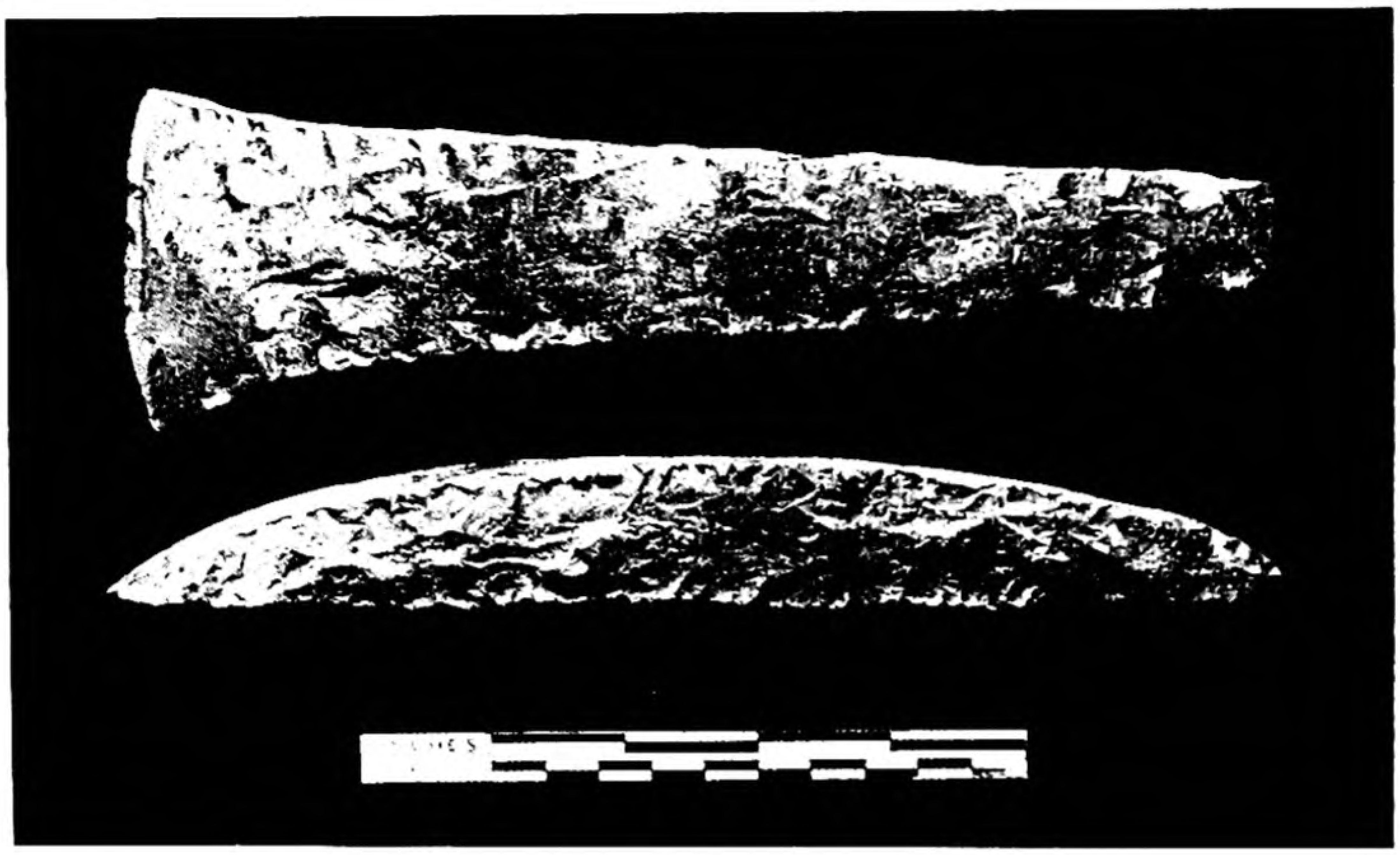
[1] Information from Professor H. D. Sankalia and Shri M. N. Deshpande.

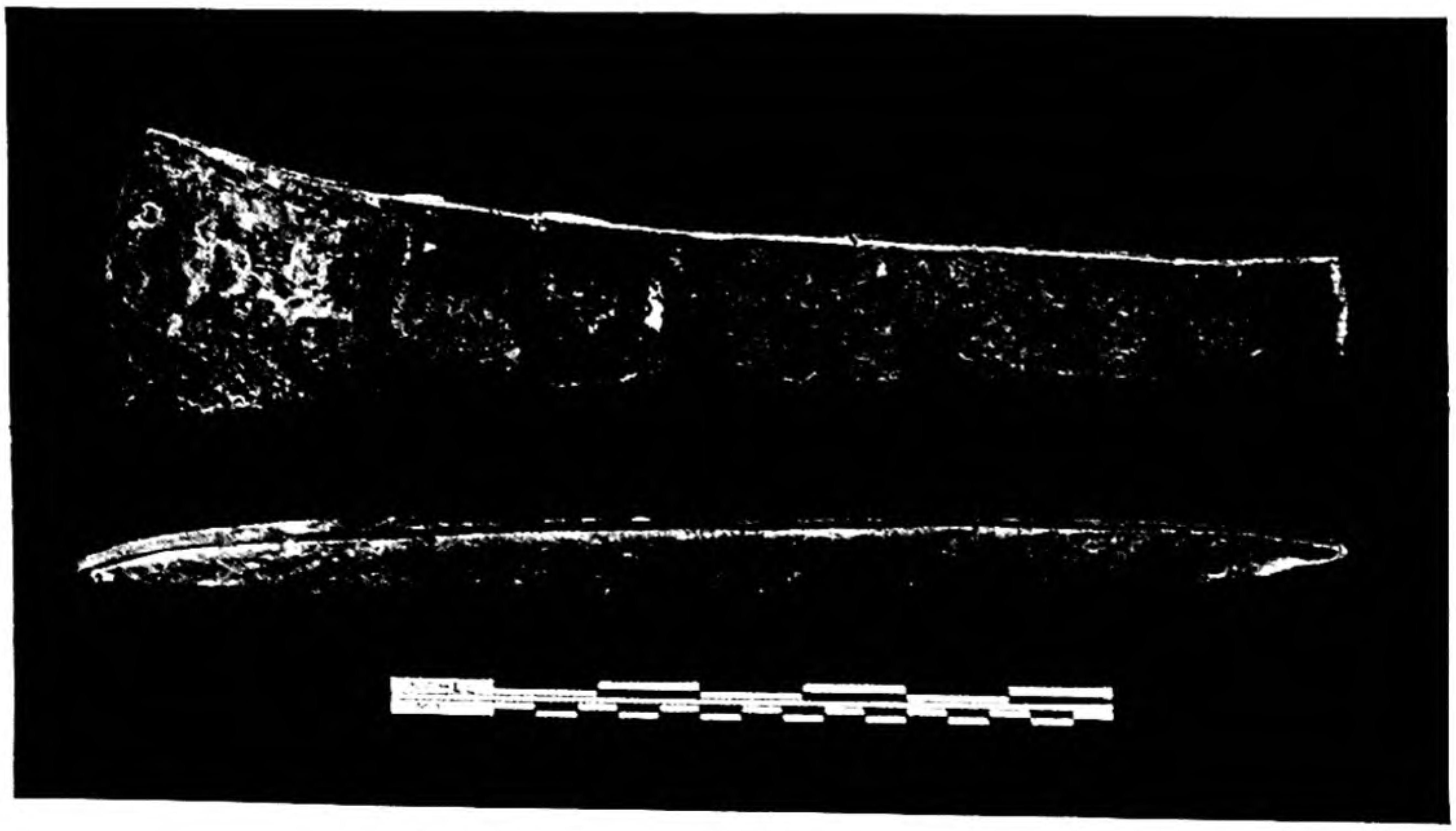
[2] The author hopes to publish shortly a detailed study on these interesting stone ' bar-celts '.

[3] E. J. H. Mackay, *Chanhu-daro Excavations* (Newhaven, Conn., 1943), pls. LXVIII and LXXI ; for Nāl specimens, cf. H. Hargreaves, ' Excavations in Baluchistan, 1925 ', *Mem. Arch. Sur. Ind.* no. 35 (Delhi, 1929), pl. XIV a.

[4] Heine-Geldern, *op. cit.* (1936), p. 102.



A. *Stone 'bar-celt' from Ban Āshuriā*
(see page 32)



B. *Copper 'bar-celt' from Gungeriā*
(see page 32)

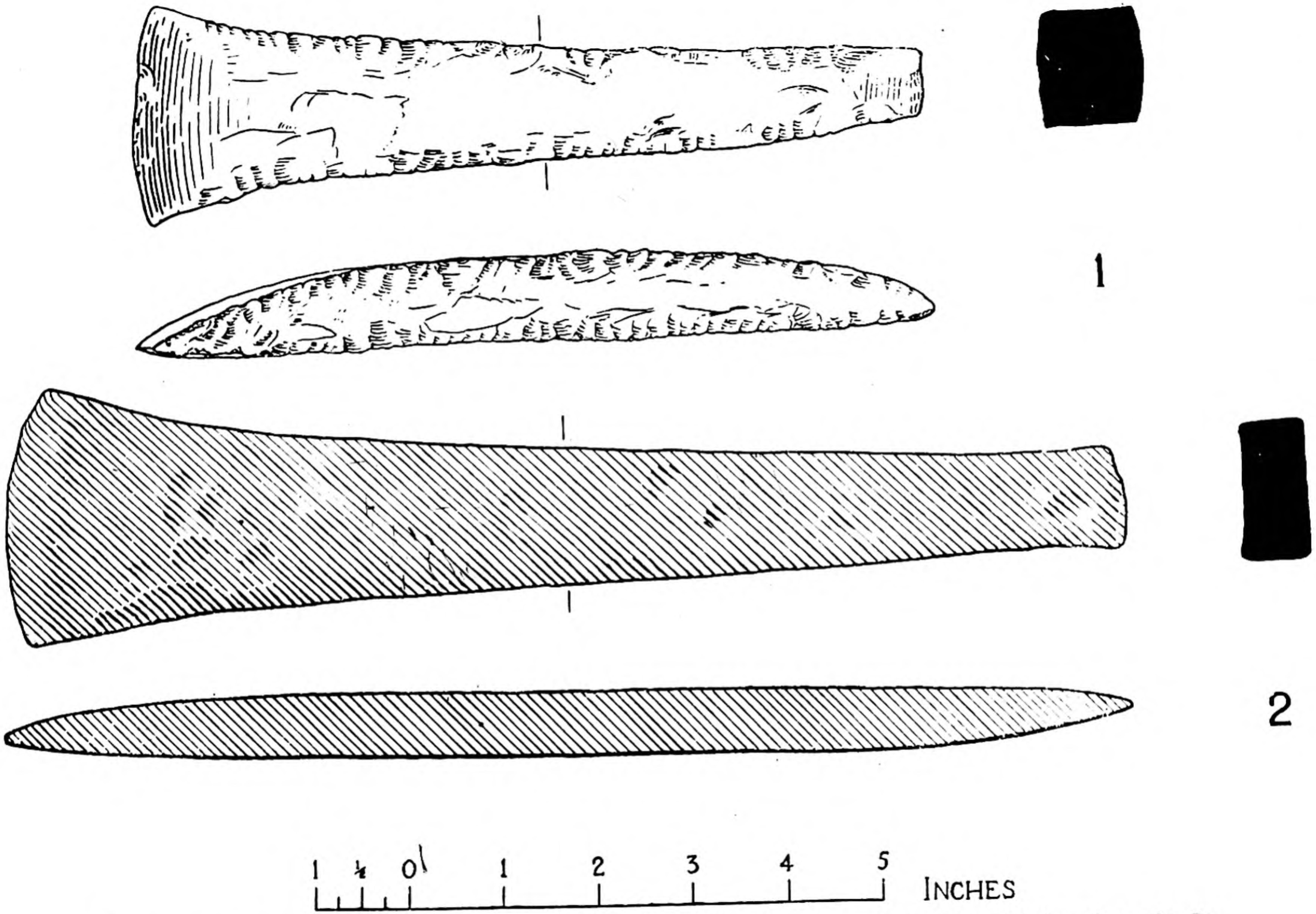

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Fig. 5. 1, *Stone 'bar-celt' from Ban Āshuriā, Dt. Bānkurā, West Bengal;* 2, *copper 'bar-celt' from Gungeriā, Dt. Bālāghāṭ, Madhya Pradesh.*

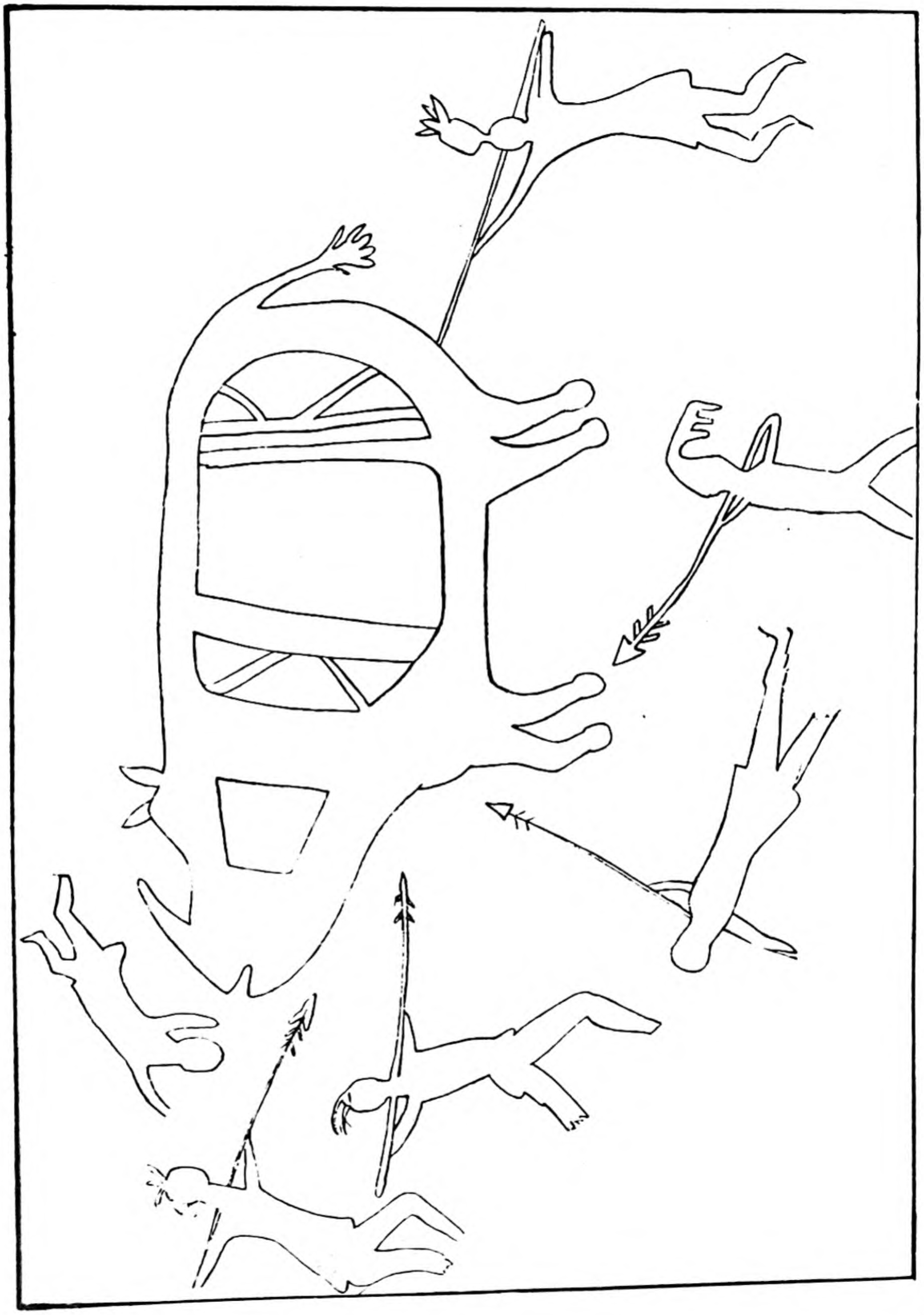

FIG. 6. *Rhinoceros-hunt, Ghormangur cave, Mirzāpur, U.P.* (after Cockburn)

But what may be worth reference here is that certain implements depicted in the archaic cave-paintings of the Central Indian plateau bear a close resemblance to the harpoons. For example, a cave called Ghormangur in the Mirzāpur District, U.P., contains a scene of rhinoceros-hunt, wherein six persons, attacking the animal from various sides, are armed with long, harpoon-headed poles (fig. 6).[1] In another cave, Likhuniā, in the same District, is portrayed a man who is about to thrust a multiple-barbed spear into the body of a *sāmbhar.*[2] Whether the implements represented in these paintings were of copper or bone or even wood and stone combined (wooden shaft with microlithic barbs) cannot be precisely determined, but whatever the raw material, the fundamental conception is indeed the same. It is therefore not unlikely that the copper harpoons of the Gangetic basin may have had some relationship with those portrayed in the Central Indian paintings.

(*vi*) *Antennae swords.*—The distinctive feature of these swords is the hilt which bifurcates like the antenna of an insect (cf. fig. 7). Outside the Gangetic basin, Kallūr (Hyderabad State) is the only place in India which has yielded swords of this type.[3] There too, the associated pottery and other finds are not known. Beyond the frontiers of India, a bronze sword belonging to the Koban culture of north Caucasia may be cited.[4] But there are some outstanding differences between the Caucasian and Indian specimens. In the former case, the hilt and blade are two separate parts, joined subsequently. Further, the hilt has a hole and the blade is flat-sectioned. In the latter case, on the other hand, the hilt and blade are of one cast, there is no hole in the hilt and the blade has a strong medial ridge. Besides, there are only a few examples of this type in the Koban culture itself. Thus, there may not be much justification in tracing the origin of the one from the other, specially in the absence of any examples from the intervening countries like Iran, Afghanistan and Pakistan. In fact, much more evidence is wanted than is available at present to decide the issue either way.

(*vii*) *Anthropomorphic figures.*—They seem to be confined to the Gangetic basin alone, since, as far as the author is aware, their occurrence has not been reported from anywhere else in the world.

From the above it will be seen that there exist no good parallels to these ' copper hoards ' in either the Indus valley cultures or any of the protohistoric cultures of western Asia. If that is true, as it seems to be, how is it that Professors Piggott and Heine-Geldern have been led to think otherwise ? The reason is not far to seek. It lies in the mixing up of issues. The two writers have assumed that the well-known sword from Fort Munro in the Panjab, the trunion celt from Shalozan in the Kurram valley, socketed axes from Shāhi Tump and Chanhu-daro and the adze-axe from Mohenjo-daro (cf. fig. 8) also belong to these ' hoards ' and can be treated

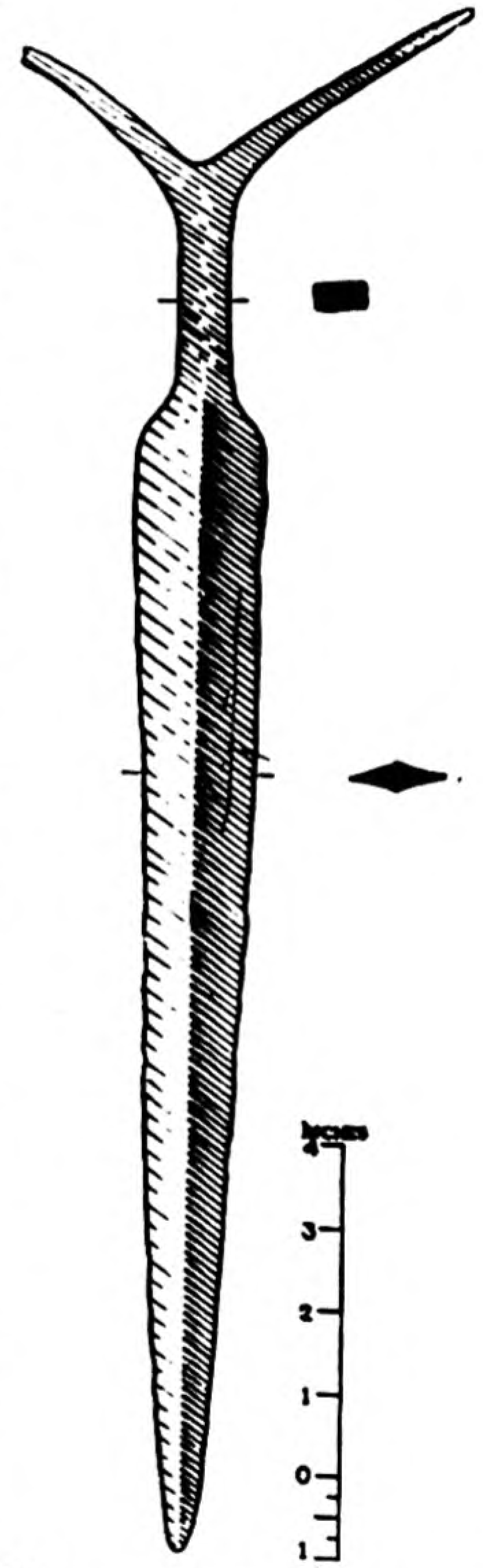

FIG. 7. *Antennae sword of copper from Fatehgarh*

as such. In point of fact this is not true. *None of the four types just stated occurs in the Gangetic basin and, conversely, no harpoon, anthropomorphic figure or antennae sword etc. occurs west of that basin. Not a single site can be named where an implement from the former group has been found in association with an implement from the latter* (cf. map, fig. 1). If this is realized, things get straightened at once.

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[1] J. Cockburn, ' On the recent existence of Rhinoceros Indicus ', *Journ. Asiatic Soc. Bengal*, LII, pt. II (1883), pp. 56-64, pl. VII.

[2] J. Cockburn, ' Cave drawing in the Kaimūr Range, North-West Provinces ', *Journ. Roy. Asiatic Soc.*, 1899, pp. 89-97, fig. 3.

[3] *An. Rep. Arch. Dept. H.E.H. Nizam's Dominions*, 1937-40, pl. V.

[4] *Materialy po Archaeologii Kavkaza*, VIII (1900), pl. X.

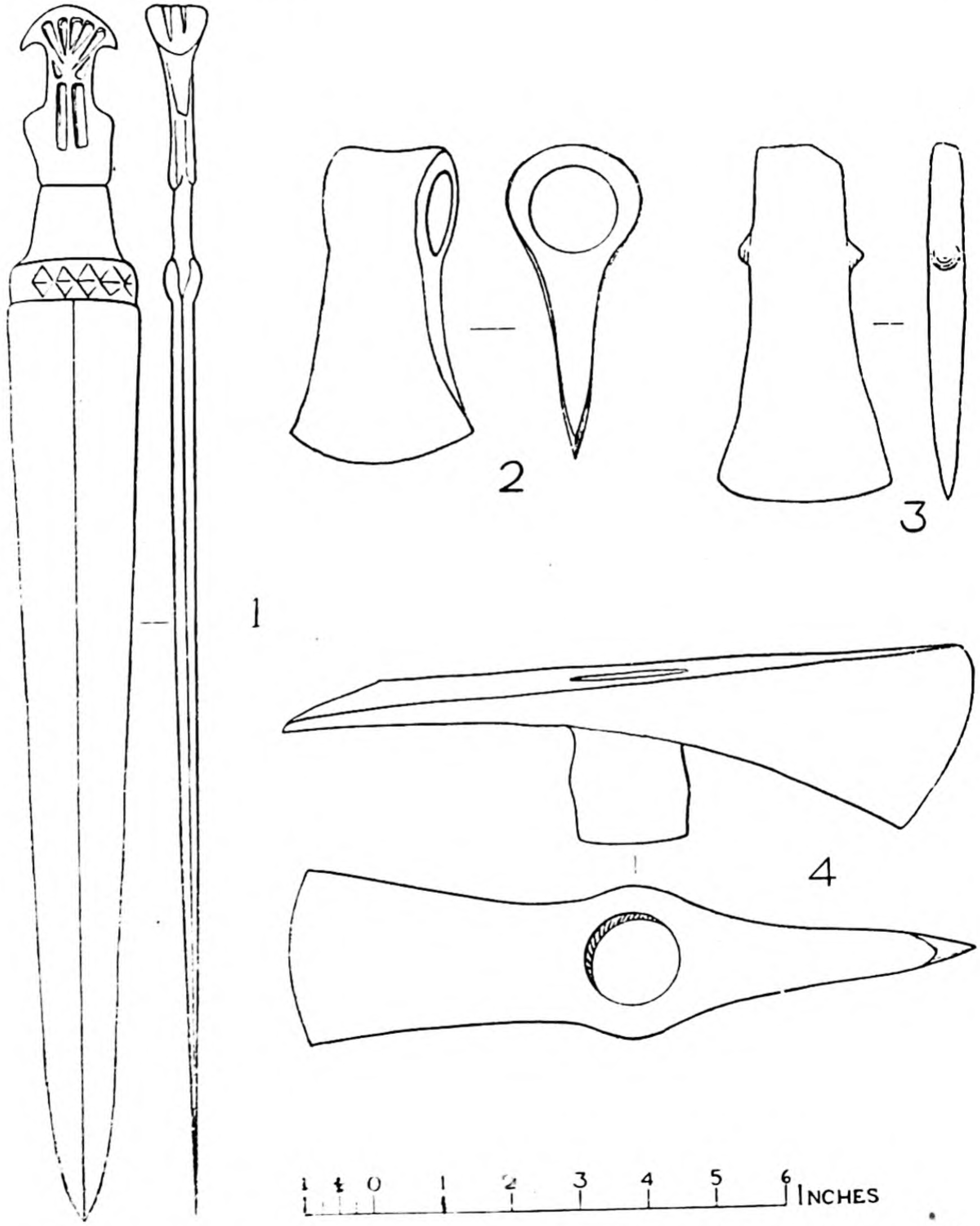

FIG. 8. 1, *Sword from Fort Munro;* 2, *shaft-hole axe from Shāhī Tump;* 3, *trunion celt from Shalozan;* 4, *shaft-hole adze-axe from Mohenjo-daro*

Here it would not be out of place to recall that almost all the implements comprising the 'hoards' are of pure copper. The specimens from Biṭhūr, Fatehgarh, Mainpuri, Gungeriā, Bisaulī etc. have amply testified to this.[1] The socketed axe, adze-axe, trunion celt, Fort Munro sword and their associated implements, on the other hand, are mostly of bronze. Again, the socket is entirely absent from the Gangetic celts. From the technological point of view also, therefore, the two groups fall out from each other.

Thus, while the socketed axe, adze-axe, trunion celt and Fort Munro sword etc., with their demonstrable West Asiatic affinities, are likely to have been associated with the upheaval and movement of people that followed the break-up of the Harappā culture, the 'copper hoards', on the contrary, seem to point to a culture which was mainly confined to the Gangetic basin with a possible southward extension across the Vindhya and Kaimūr ranges.

Who were then the authors of this 'copper hoard culture'? As stated above (p. 27), a trial excavation very close to the find-spot of the Bisaulī hoard produced rolled fragments of an ill-fired, thick, ochre-washed ware which may have been associated with the implements.

Another copper-hoard site, Rājpur Parsu, was explored by the writer in October, 1949, to see if it could throw any light on the subject. An octogenarian, who claims to have shown Vincent Smith the find-spot nearly fifty years ago, took the writer also to the place. It is a mango-garden on the north-eastern periphery of a mound which is about 5-7 ft. high and covers an area nearly 4 square furlongs. Five small trenches were laid out, one in the mango-garden and four at various points on the mound. Though very little deposits were met with in the garden itself, occupational strata went to a depth of nearly 8 ft. in the mound. No copper implements were obtained, but the lower levels produced the same kind of ill-fired, thick, ochre-washed, rolled pottery as was found at Bisaulī. This coincidence naturally makes one repeat the question—are the copper implements and the pottery products of the same culture? If the answer be in the affirmative (which only further work at these sites can finally decide), it may perhaps be possible to identify the authors one day.

4. ACKNOWLEDGEMENTS

The author's grateful thanks are due to Shri B. M. Vyas and Shri S. C. Kala of the Municipal Museum, Allahabad, Shri Rai Krishna Das, Shri U. S. Sastri and Shri Vijayakrishna of the Bhārat Kalā Bhavan, Banaras, Shri M. M. Nagar of the State Museum, Lucknow, Shri S. A. Shere of the Patna Museum, Patna, and Shri C. Sivaramamurti and Shri D. P. Ghosh respectively of the Indian and Ashutosh Museums, Calcutta, for the facilities afforded by them in connection with the study of the copper and stone implements lodged in their respective museums. He is indebted to Dr. B. B. Lal, Archaeological Chemist in India, Dehra Dun, for the chemical analysis of the anthropomorphic figure from Bisaulī. He would be failing in his duty if he did not thank Shri B. K. Thapar for his assistance during the explorations at Bisaulī and Rājpur Parsu, Shri K. K. Sinha for lending a hand in the preparation of the Table (p. 38 A) and Shri L. Dutt, Shri S. K. Neogi, Shri S. P. Jain, Shri S. Ghosh, Shri K. C. Das and Shri R. Chatterji for preparing the line-drawings, map and photographs etc.

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[1] Cf. Smith, *op. cit.* (1905), and the report of the Archaeological Chemist on the Bisaulī specimen, above p. 24.

POSTSCRIPT

Since some delay has been caused in the publication of this article, an opportunity is taken here to refer to the excavations at Hastināpura near Meerut (west Uttar Pradesh), carried out by the author during 1950-51 and 1951-52. The lowest levels of this site also yielded an ill-fired, thick, ochre-washed pottery. Since the sherds are very fragmentary and limited in number, it is difficult to ascertain the complete shapes of the pots. However, the fabric, wash and general look of the specimens from the three sites, viz. Bisaulī, Rājpur Parsu (above, p.p. 27, 37) and Hastināpura suggest that they might belong to one and the same class.[1] At Hastināpura the strata overlying this pottery contained Painted Grey Ware, which appears to have been associated with the Aryans when they occupied the upper basins of the Sutlej, Sarasvatī, Yamunā and Gangā round about 1000 B.C.[2]

Thus, if the copper hoards are to be associated with the ill-fired, ochre-washed, thick ware, it would follow that they are the products of a people who inhabited the Gangetic basin, presumably before the arrival of the Aryans. Who exactly these pre- and non-Aryans were it is very difficult to determine in the present state of our knowledge, but it may not be out of place to recall here two typological observations made previously (p. 32, 35). First, the bar-celt, which constitutes an important type among the copper-hoards, seems to have developed from stone celts of a similar shape occurring in the hilly tracts of north-eastern Madhya Pradesh, southern Bihar, western West Bengal and northern Orissa. Secondly, the harpoon, another outstanding type in the copper hoards, has a resemblance to certain tools depicted in the cave-paintings of Mirzāpur in southern Uttar Pradesh. If these similarities have any significance, it would appear that the authors of the copper hoards were once associated with the areas just stated. At

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[1] Of course more material is necessary to establish the similarity fully.

[2] The evidence suggesting the association of the Painted Grey Ware with the Aryans is mainly of a circumstantial kind, and until positive ethnological and linguistic proof is obtained, the equation must be regarded only as provisional. See, in this connexion, the author's paper, 'The Painted Grey Ware of the upper Gangetic basin : an approach to the problems of the Dark Age' *Journ. Roy. Asiatic Soc. Bengal* (Letters), N.S., XVI (1950), pp. 89 ff., reviewed by S. Piggott in *Antiquity*, 99 (Sept. 1951), p. 166.

The report on the excavations at Hastināpura, 1950-51 and 1951-52, will be published in an early number of *Ancient India*. Meanwhile, a short note has appeared in the *Illustrated London News*, Oct. 4, 1952. Unfortunately, however, no mention of the 'ochre-washed' ware has been made in that note. Circumstances leading to this omission may perhaps be briefly stated here.

The first season's work at Hastināpura came to a close at the end of March 1951, and on April 10, 1951, the writer had to leave India for further studies abroad. He had, therefore, hardly any time to look into the pottery that was recovered during the last few days of the excavation from the levels immediately overlying the natural soil. He carried with him the impression that the Painted Grey Ware was the earliest ceramic industry of the site and accordingly submitted the note to the *Illustrated London News* about October 1951.

After his return to India in November 1951, the author resumed work at Hastināpura. This time a much wider area was dug in the lowest levels and it was observed that between the natural soil and the Painted Grey Ware strata there was a deposit, varying from ½ to 1 foot in thickness; and at places even entirely absent having been cut away by subsequent pits, which contained a different class of pottery, viz. the ochre-washed ware. On an examination of the pottery from comparable levels of 1950-51 excavations it was found that there did exist a few sherds of this ware in that collection. Owing to lack of time prior to his departure abroad, the author could not look into these sherds, for which act of negligence he tenders his apologies.

TABLE SHOWING THE DISTRIBUTION OF 'COPPER HOARDS' AND OTHER

Serial Number	Locality	District and State	'COPPER HOARDS'									
			Flat celt	Shouldered celt	Bar-celt	Hatchet or '*paraśu*'	Double-edged axe	Ring	Anthropomorphic figure	Harpoon	Antennae sword	Hooked sword or spear-head(?)
1	Baragunḍā	Hazāribāgh District, Bihar	1	...	...	...	...	1	...	...	...	...
2	Bartol	Rānchi District, Bihar	21	...	...	...	...	...	...	...	...	...
3	Bhagrā Pīr	Mayūrbhanj, Orissa	...	...	...	...	3	...	...	...	...	...
4	Bichnā	Rānchi District, Bihar	1	...	...	...	...	...	...	...	...	...
5	Bisaulī	Badaun District, U.P.	1	...	...	...	...	...	3	1	...	...
6	Biṭhūr	Kanpur District, U.P.	26	7	...	...	...	...	...	7	1	...
7	Dargāmā	Rānchi District, Bihar	5	...	...	...	...	...	...	...	...	...
8	Deoṭī	Lucknow District, U.P.	1	...	...	...	...	...	...	...	...	...
9	Dhākā	Shāhjahānpur District, U.P.	...	5	...	...	...	...	...	...	...	...
10	Dunriā	Pāl Lahārā, Orissa	...	1	...	...	...	...	...	...	...	...
11	Fatehgarh	Farrukhābād District, U.P.	...	...	...	...	...	...	1	...	13	1

present these tracts are known to be chiefly occupied by the Mundas, Santhals and other tribes belonging to the Proto-Australoid group of the Indian population. Can it then be said that the ancestors of these Proto-Australoid tribes were responsible for the copper hoards? The archaeological evidence available at present is indeed too meagre to answer the question, but literary evidence may be of some interest here. The Vedic Aryans, on reaching the plains of northern India, encountered certain aboriginal tribes whom they called the *Nishādas* and described them as having a dark complexion, short stature and flat nose (*anās*).[1] Since more or less the same physical features characterize the Proto-Australoid tribes, the question posed above would appear to gain support from the Vedic literature itself. But looking to the cultural equipment of these tribes at the present day one wonders if their ancestors were capable of producing the highly-evolved implements some 3000 years ago. Such an objection, however, is subjective rather than objective and may lose its force when it is recalled that the mighty cities of Harappā and Mohenjo-daro were never reproduced by the cultural heirs of that civilization.

The author does not claim to have solved the problem. In fact he has made it more complicated than it was hitherto believed to be by raising an altogther fresh issue. Let it be left to the spade now to give the final verdict.

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[1] Macdonell and Keith, *Vedic Index* (London, 1912), I, pp. 453-54; R. Chanda, *The Indo-Aryan Races* (Rajashahi, 1916), I, pp. 4-11. These references would make it clear that the Nishādas were 'too powerful to be enslaved or expelled *en masse*. The Aryans were compelled to meet them half way.'

THE LITHIC TOOL-INDUSTRIES OF THE SINGRAULI BASIN, DISTRICT MIRZĀPUR[1]

By V. D. KRISHNASWAMI and K. V. SOUNDARARAJAN

In this article the authors deal with the palaeolithic and microlithic artefacts collected from the Singrauli basin, District Mirzāpur, U.P. in 1949, mainly in an expedition led by Professor F. E. Zeuner of the University of London. The palaeoliths, ascribed generally to the Mid-Pleistocene period, show a dominance of the biface Madras tradition influenced by Sohan (Levallois) flaking technique. No less interesting are the microliths occurring deep in the Upper Alluvium, unassociated with pottery. Unlike the well-known chert and chalcedony microliths of central India, they are mainly manufactured out of quartz and may therefore represent an altogther different tradition.

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1. INTRODUCTION

ONE of the fundamental Stone Age problems in Indian prehistory is the correlation between the now-established Himalayan glacial cycle and the observed Peninsular pluvial cycle and the clarification of the links between them into a pan-Indian scheme. In 1883 J. Cockburn collected from the Singrauli basin in south Mirzāpur, in Uttar Pradesh, Stone Age artefacts allied to the Madras industry.[2] After the lapse of half a century, in 1935, De Terra, while working on the establishment of the Pleistocene sequence

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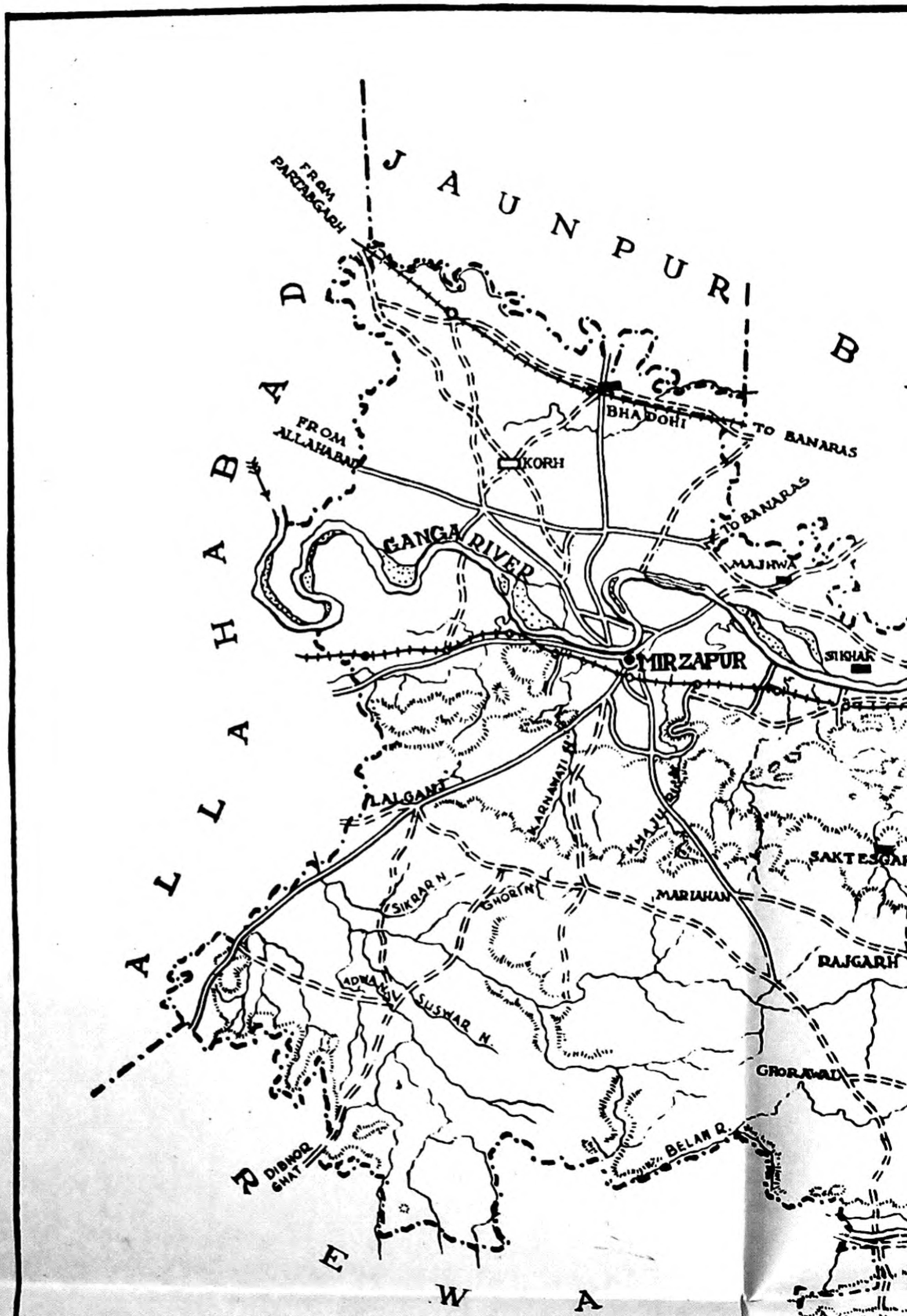
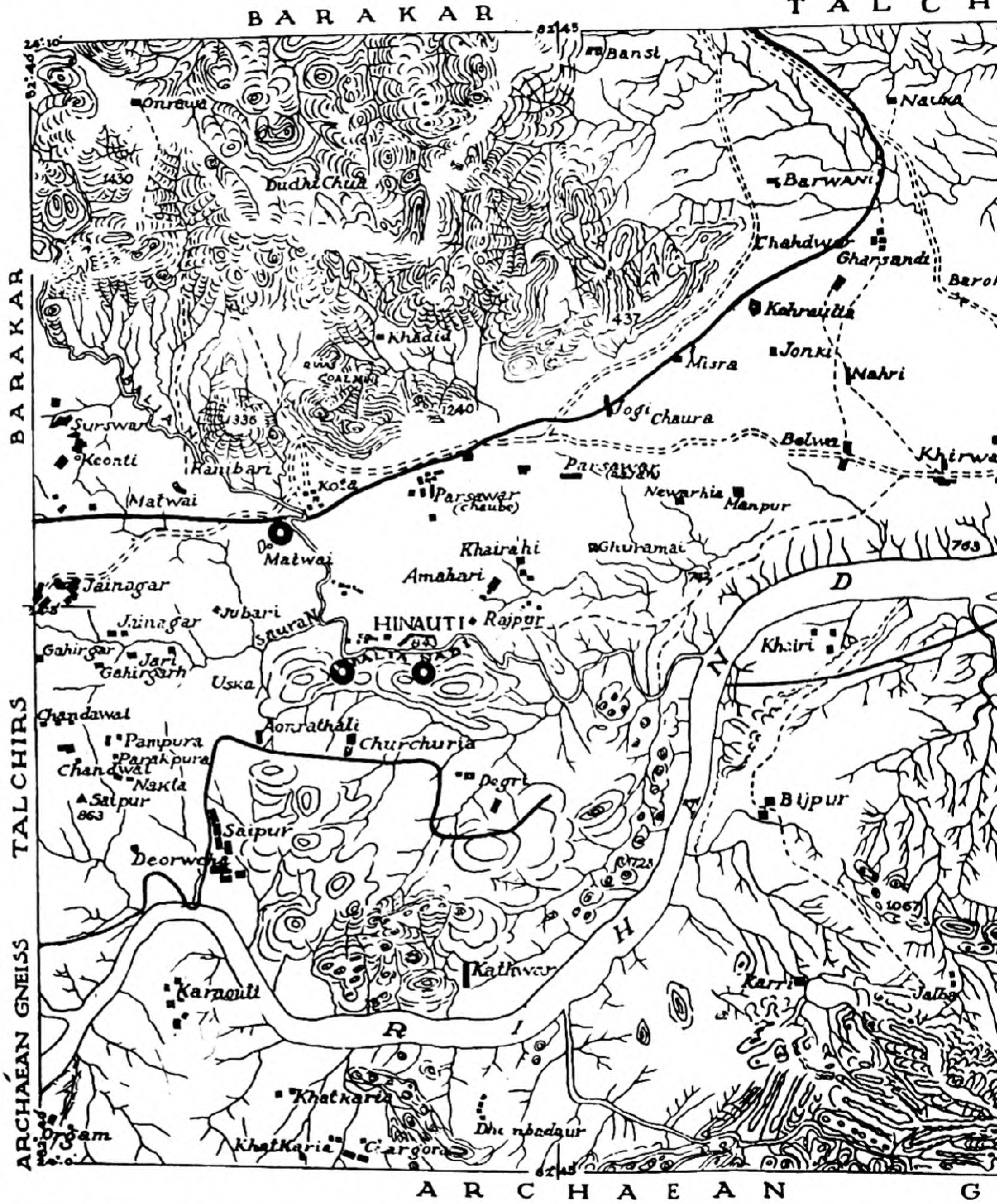
[1] Read before the thirtyseventh session of the Indian Science Congress, Poona, 1950.

[2] J. Cockburn, 'On palaeolithic implements from the drift gravels of the Singrauli basin', *Journ. Anthrop. Inst.*, XVII (1888), pp. 57-65.


JAUNPUR
ALLAHABAD
B
REWA
FROM PARTABGARH
BHADOHI
TO BANARAS
FROM ALLAHABAD
KORH
TO BANARAS
GANGA RIVER
MAJHWA
MIRZAPUR
SIKHAR
LALGANJ
KARNANATI N.
KHAJURI N.
SAKTESGA
MARIAHAN
SIKRAR N.
GHORI N.
RAJGARH
ADWA N.
SUSWAR N.
GHORAWAL
BELAN R.
DIBNOR GHAT

To follow plate XII

PHYSIOGRAPHY OF T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Chahdwar
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Jonki
Nahri
Khadia
437
Misra
Coal Mine
1336
1240
Jogi Chaura
Surswar
Keonti
Belwa
Khirwa
Ranibari
Kota
Parsawar (Chaube)
Newarhia
Manpur
Matwai
Matwai
Khairahi
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● PALAEOLITHIC LOCALITIES (I, II & III) DESCRIBED

in Kashmir, Panjab and central India by correlating geological with associated human cultural data, made a reference to Mirzāpur[1] independently of Cockburn's finds in that region, of which he was unaware. He expressed the need for an investigation of the patches of the fossiliferous Middle Pleistocene lying in the Mirzāpur area and felt that laterite gravels, though not recorded here so far, must exist, since they occur a little further south in the Narmadā valley. 'Here,' he said, 'in the northern rim of the ancient Indian land-mass, lies a field of investigation important for the geologist and prehistorian alike, owing to its position between the glaciated Himalayan highland and the peninsular tropical belt.'

Again, De Terra proved that the two stone tool-traditions, viz. the Sohan and the Madras, met in the Narmadā, and, to a certain extent, this was also the case, as the first author has observed,[2] along the Sābarmatī in Gujarat, round about Vijāpur and Peḍhamli. In the south-east, not very far from the Singrauli basin, at Kuliāna in Mayūrbhanj[3] (Orissa), the palaeolithic culture is a full-blooded Madras biface industry. Thus, the Singrauli basin in Mirzāpur comes out as the pivotal region for revealing such a contact by virtue of its geographical and cultural position.

Hence, the pan-Indian prehistoric exploratory expedition conducted in 1949 by Dr. F. E. Zeuner, Professor of Geochronology, Institute of Archaeology of the University of London, and the first author, under the auspices of the Department of Archaeology, Government of India, also covered, among other sites, the Singrauli basin. This expedition in the Singruali basin was preceded by a preliminary exploration of the area in January 1949 by the first author,[4] during which the palaeolithic site was re-discovered on the south bank of Baliā Nadī opposite Hinauti. This, in all probability, was Cockburn's site as well. After the only reference to the Stone Age site by Cockburn in 1888 no attempt had been made to visit or explore this inaccessible area, and the work of our expedition will stand as an important pioneer-work in the south Mirzāpur region.

2. MORPHOLOGY AND GEOLOGY OF THE SINGRAULI BASIN

A. Physical features

The District of Mirzāpur (pl. XII) is bounded on the north by Jaunpur and Banaras Districts, on the east by the Districts of Shāhābād and Pālāmau, on the south and south-west by Sirgujā and Rewā (both now in Vindhya Pradesh) and on the north-west by the District of Allahabad.[5] Excepting on the north-east, where the Gangā forms an 8-mile long boundary, it is a heterogeneous tract, roughly 125 miles north-south and 90 miles east-west.

The country presents a relieving change from the monotonous flat alluvial topography of the Gangetic plain along its northern border to an essentially jungle-clad hilly region in the south and falls into three sharp physiographic divisions. In the north is the alluvial plain which skirts the Gangā on either bank and extends from the northern boundary about 6 miles southwards up to the abrupt scarp of the low flat-topped line of hills into which the range of the Vindhyas here subsides. The next division is the central or Vindhyan escarpment and the Kaimūr range, at an average elevation of 500 ft. above the valley of the

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[1] H. De Terra and T. T. Paterson, *Studies on the Ice Age and Associated Human Cultures* (1939), p. 313.

[2] V. D. Krishnaswami, 'Stone Age in India', *Ancient India*, no. 3 (1947), pp. 11-57.

[3] N. K. Bose and D. Sen, *Excavations in Mayurbhanj* (1948).

[4] The Allahabad University deputed Mr. G. R. Sharma of its History Department to take part both in the preliminary exploration and in Professor Zeuner's expedition in the Singrauli basin.

[5] D. L. Drake-Brockman, *A Gazetteer of the Mirzapur District* (1911).

Gangā. This is in extent some 70 miles from east to west, and varies from 20 to 30 miles in width from north to south. The southern boundary of this second physiographic division is formed by the Kaimūr Range, and further south the plateau terminates in an abrupt precipice overhanging the valley of the Son. The third geomorphic feature is the country south of the Son river consisting for the most part of numerous parallel lines of rocky hills of no great height but rugged and clothed with stunted, ill-grown jungle. It has three main river-valleys, those of the Kon, the Dudhi and the Rihand (draining the Singrauli basin), all tributaries of the Son.

B. GEOLOGY

Geologically[1] the country is divisible from north to south, in conformity with the three above-mentioned physiographic zones (pl. XIII), into the recent Gangetic alluvium stopping abruptly with the escarpment of the Vindhyan sandstone plateau which continues roughly upto the Son river, where we get an inlier of the lower Cuddapah series (Bijawars) consisting of cherty limestones and ferruginous sandstones and quartzite as well as slates. A little further south, a patch of Dharwars runs east-west, the prevalent formation of this being laminated limestones, phyllites and slates. This again is overlain by the Barākar beds of the Lower Gondwanas and the Upper Gondwanas appear still southwards. The Gondwana beds occur principally in the western parts of the Singrauli basin and consist of the lower division of the Talchir beds, a homogeneous group of green laminated shales and soft friable sandstones, constituting a stratigraphical horizon, followed by tillites ascribed to Permo-Carboniferous glaci-fluvial origin. The Rihand river cuts across the Archaean gneiss and runs parallel to the outcrops of the Barākars for some distance in a north-east direction and breaks through the Dharwars before joining the Son at Sindhuriā.

In the higher portions of the Singrauli basin, as in the Bichi Nālā and Baliā Nadī, the boulder drift of the Talchir series is exposed in an eroded state, the surface of which is the implementiferous horizon, as observed by us.

C. THE RIHAND TERRACE-SYSTEM AND THE BICHI NĀLĀ

Our expedition in April 1949 took the route from Mirzāpur viâ Robertsganj and Pipri and thence to Koṭā due west and thus had the chance of crossing the courses of the Bichi Nālā and the Rihand to reach finally the Baliā Nadī—a route totally different from what had been taken during the preliminary exploration. The section (fig. 1) of the Rihand at a place midway between Koṭā and Pipri presents a 30 ft. alluvial cliff indicating a double cycle of deposition of gravel and silt overlying the basal boulder conglomerate of the Talchirs. The Talchirs, exposed here to a depth of 4 ft., are succeeded by a 5 ft. bed of gravel, which, in turn, is followed by a reddish silt, about 10 ft. thick. Above this, a second cycle of deposition is repeated to a height of 10 ft. On the left bank the gravel-bed was only 15 ft. high, since the second cycle of deposition was not perceptible. Here, a few tools, both bifaces and flakes, were recovered from the gravels consisting of variegated pebbles of quartz, trap, gneiss and jasper (no. 17, fig. 3 ; pl. XVI).

There is clear evidence for two terraces on the Rihand river near Pipri also, where a dam was being erected by the Uttar Pradesh Government. On the top of the south

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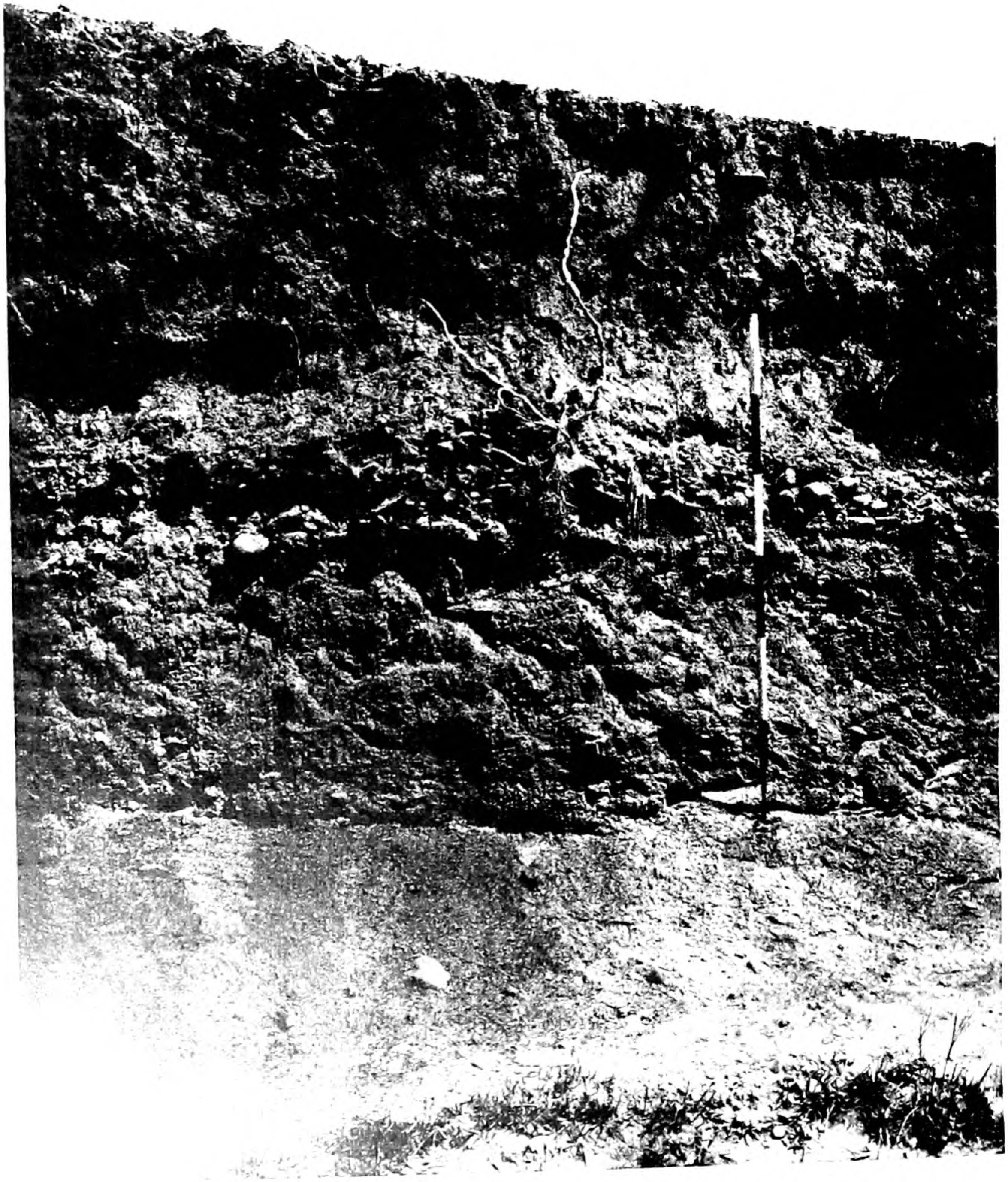
[1] R. D. Oldham, P. N. Dutta, and Vredenburg, 'Geology of the Son valley in the Rewa State and parts of the adjoining Districts of Jabalpur and Mirzapur', *Mem. Geol. Surv. Ind.*, XXXI, pt. 1.

General view of the Baliā Nadi, showing the scatter of gravel on the bank



[illegible] section on the southern bank of the Baliā Nadi opposite Hinauti

bank here, at a height of 80 ft. from the present river-bed, there is an aggradational terrace, and nearly 43 ft. below this there is again another undulating terrace, at places with 10 ft. depression. The present flood-plain is 37 ft. below this second one. On the opposite bank, however, there is a terrace level 22 ft. above the modern flood-plain, i.e., nearly 15 ft. below its counterpart on the southern side, and this too had a deposition of gravel on it.

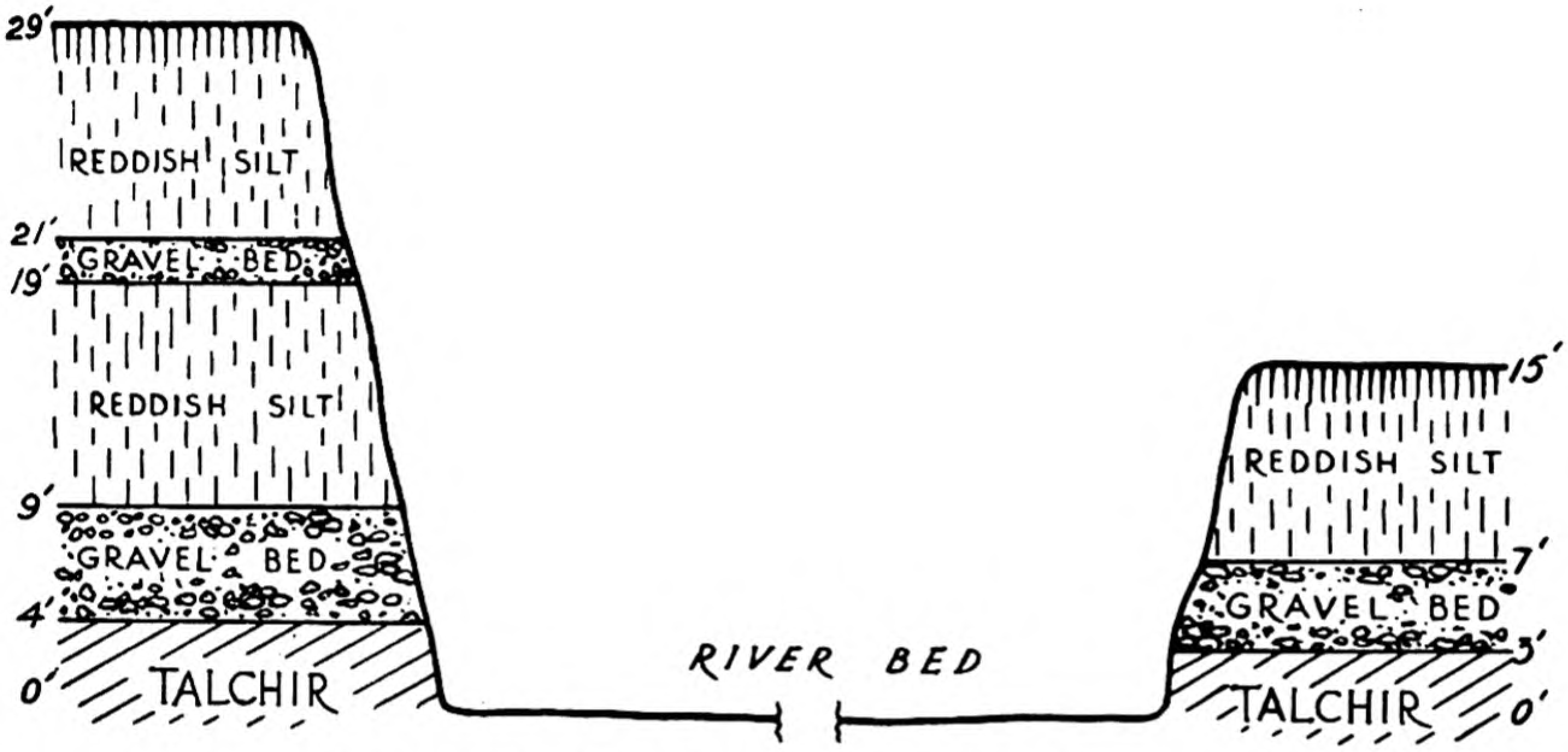


FIG. 1. *Diagrammatic section of the Rihand river midway between Koṭā and Pipri*

The Bichi Nālā, an affluent of the Rihand from the south, presents a huge aggradational phase with gravels capped by reddish silt (more than 60 ft. in thickness), and the relationship of the double cycle of deposition observed in the Rihand with this remains to be studied. At the same time, that this gravel deposit too is implementiferous as that on the Rihand, mentioned above, is shown by the discovery of two tools washed down into the Bichi Nālā, one, a much rolled quartz Acheulian coup-de-poing (no. 52, fig. 5 ; pl. XVIII), and the other, a huge Clactonian flake of grey laminated quartzite, with a prominent bulb of percussion and plain striking platform at an angle of 135° to the primary flake-surface (no. 166, fig. 7).

It was in this area, in the vicinity of Gaharwārgāon, in the alluvium, at places 50 ft. thick, that Cockburn obtained the fossil tibia and portions of the femur of the left pelvic limb of a large *Bos* indistinguishable from those of an adult male *Bos Gaurus*, kept in the Indian Museum, Calcutta.[1]

D. LATERITE IN MIRZĀPUR

A laterite quarry, locally called the 'Lusa quarry', was casually observed some 30 miles from Chopan north of Robertsganj (24° 43′ N. ; 82° 49′ E.), lying upon a quartzite plateau.[1] The presence of laterite in the Mirzāpur area had already been visualized by De Terra owing to its presence in the Narmadā, where the laterite was dated by him, on fossil-evidence, to the Early Pleistocene and prior to the human culture there. We have further reasons to expect laterite of a similar nature and age, since the Singrauli basin and the Narmadā are almost equidistant from and adjacent to the Tropic of Cancer and the headwaters of both the Narmadā and the Rihand are just below the Tropic of Cancer almost at the same latitude. This shows that the climatic conditions which helped lateritization[2] in these areas might have been very similar.

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[1] Cockburn, *op. cit.*

The laterite sample from 'Lusa quarry' exhibits the characteristic tubular or the vermicular structure with white aluminous patches and at places has got the mammiform structure and glaze. This appears to be an *in situ* lateritization of the underlying Vindhyan quartzites, the outcrop of which is seen in the neighbourhood. It cannot be assumed that because there are sandy grains in the specimen, it should be of the detrital variety, since the parent-rock from which it developed is itself quartzite. Around the Mirzāpur area laterite occurs in scattered patches on the Vindhyan uplands of the northern part of Rewā.[3] In Baghelkhanḍ a hill of Bundair limestone, 10 miles N.N.E. of Nagoḍ, is capped with laterite, and Baraundā Hill (1,400 ft. high), of Kaimūr sandstone, south of Parāri, is also similarly capped. Laterite also 'caps the Pats of Sirgoojah, 30 miles south and even occurs north of the Sone River, near Sookerit, 21 miles south of Chunar, on the Ganges.'[4]

Till we get a section, as in the Narmadā, where the Pleistocene cycle is in contact against an eroded surface of laterite to make it belong to the Lower Pleistocene, it is not possible in the present state of our knowledge to date the Mirzāpur laterite. All that can be said of it is that it may belong to the same age or might even go into the Pliocene.

3. THE PALAEOLITHIC INDUSTRY

A. COCKBURN'S OBSERVATIONS

Palaeolithic implements made of quartzite, chert and other stones were discovered by Cockburn, as stated above (p. 40), on an undulating ground along the south bank of the Baliā Nadī, an affluent of the Rihand, forming the border-line between the Mirzāpur District and Rewā (pl. XIV). They occurred, Cockburn records, in great profusion in a gravel-bed which was in some places exposed and disintegrated but, in another, lay beneath an alluvial stratum varying in thickness from 8 in. to 20 in. Where exposed, the gravel was cemented into a mass by the carbonate of lime, and sometimes the implements had to be extracted with a chisel. The village of Mahri in the vicinity of the Bichi Nālā forms the extreme eastern point where the implements have been obtained, Hinauti forming the extreme western point. The gravel was composed of 'quartzite, vein quartz, chert, jasper, gneiss, tourmaline, granite and epidote', etc. It rested upon a Talchir boulder-bed of Permo-Carboniferous glacial origin, which rested in its turn upon the strata of red and green sandstones of the Barākar group. No animal-fossils were found by Cockburn in association with the artefacts or in the immediate vicinity. The tool-types were neither described nor illustrated by him.

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[1] The Geological Survey of India informs us that this area has not been surveyed in great detail and that so far as is known it belongs to the Dhandraul quartzites of the Kaimūr series in the (Upper) Vindhyan formation.

[2] Krishnaswami, *op. cit.*

[3] C. S. Fox, 'The bauxite and aluminous laterite occurrences in India', *Mem. Geol. Surv. Ind.*, XLIX (1928), pp. 105-7.

[4] Cockburn, *op. cit.*

It looks as though Cockburn could not distinguish the boundary between the Pleistocene fluviatile gravels yielding Stone Age tools and the glaci-fluvial morainic deposit. The tools collected by Cockburn were deposited in the British Museum and so were not available to Indian scholars. Thus the importance of the region received no notice.

In 1897 Oldham picked up a few palaeoliths near Rewā Town (in the Tamasā basin); these, later recorded by Foote,[1] belong to the same lithi-cultural region as our Singrauli basin tools (below, p. 63).

B. THE PALAEOLITHIC LOCALITIES ON THE BALIĀ NADĪ

About 15 miles due west of the Bichi Nālā is Koṭā. The section exposed in the bank of the Baliā Nadī, at the Z-shaped bend between the village of Koṭā and the junction of the Baliā Nadī with the Saurā Nālā (Locality I) shows about 10 ft. of mottled clay containing a bed of gravel. It is covered with loamy sand with layers of lime concretion (kankar) and about 18 in. of a light brown soil. The section measures about 20 ft. and bed-rock is not exposed. It is possible that there is more than one layer of gravel in the mottled clay.

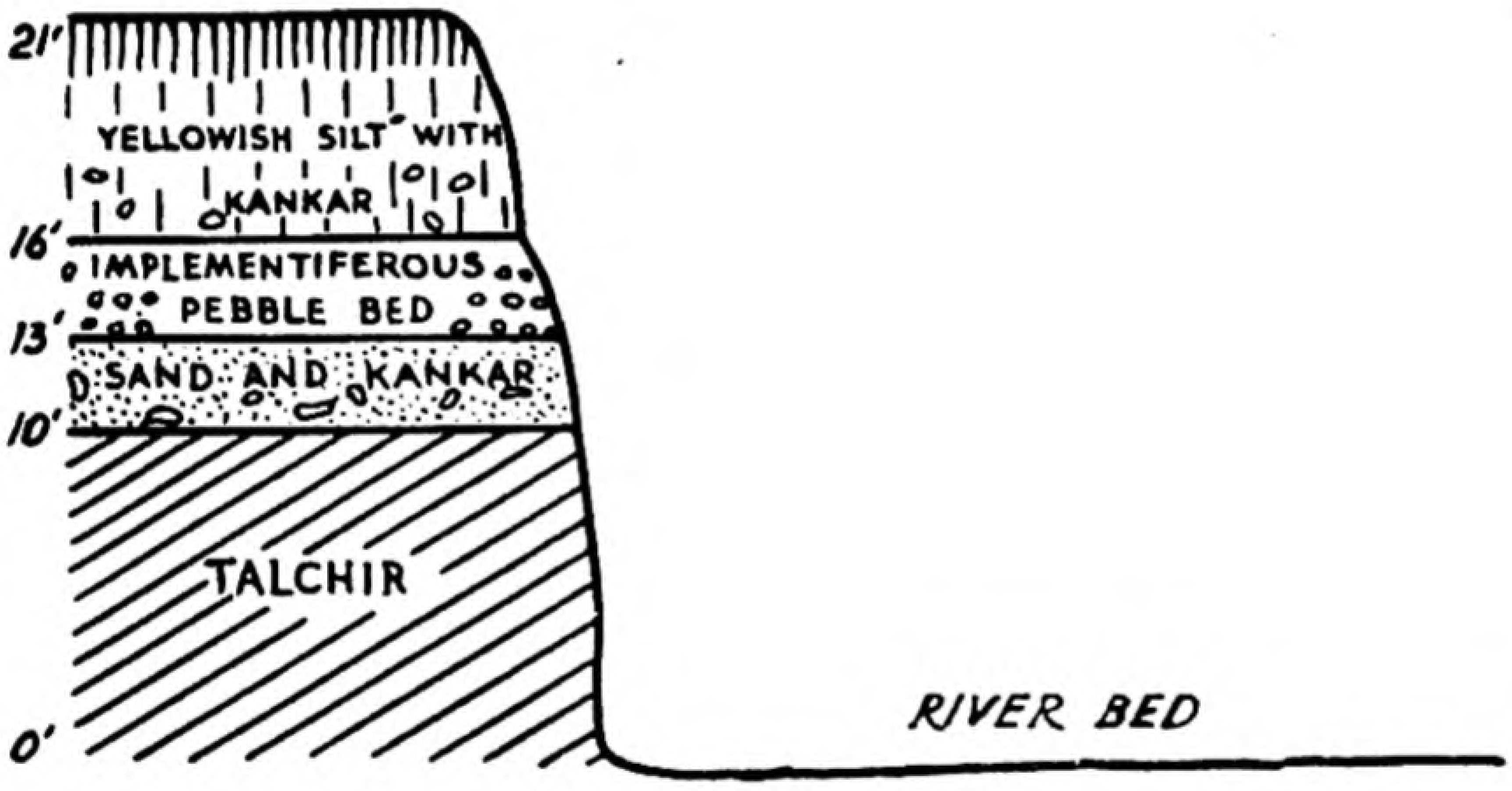

FIG. 2. *Diagrammatic section opposite Hinauti on the Baliā Nadī*

A few miles south of this the palaeolithic site was located, opposite the village of Hinauti, on the southern bank of the Baliā Nadī, just inside the Rewā borders. West of Hinauti, past the junction between Baliā Nadī and Saurā Nālā, where the river meanders and strikes the southern bank (Locality II) the cliff-section (pl. XV) consists of a thin mantle of surface-humus, underneath which is a yellowish alluvial silt of 5 ft. thickness with kankar pellets (fig. 2). A pebble-bed, 3 ft. thick with kankar nodules and containing tools as well, comes next, passing downwards into an underlying sand and kankar deposit (in stalactites) of equal thickness. This, in turn, rests upon the Talchirs, the bed-rock, which is exposed to a considerable height in the cliff.

Downstream from Locality II, not far from Hinauti, the section (Locality III) is essentially the same as in Locality II, but the surface of the Talchir conglomerate is only about 6 ft. above the floor of the Baliā Nadī, and the whole section measures hardly more than 12 ft. in height.

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[1] R. B. Foote, *Indian Prehistoric and Protohistoric Antiquities—Notes on Ages and Distribution* (1916), p. 161.

A couple of tools, both of them Early Sohan pebble chopper types (nos. 1-2, fig. 3; pl. XVI) in a rolled state, was found *in situ* in the derived aggradational pebble-deposit in this section, but the majority of the artefacts, as seen by us, were lying in the fluviatile gravel, resting inseparably on the glacial moraine on the highest reaches comprising 'pebbles and boulders of all sizes from an oval pebble one quarter of an inch in length to blocks 15 ft. in diameter'. The Talchir boulder-conglomerate having supplied inexhaustible lithic raw material for the tool-makers, the site became a factory. There was no way of differentiating the Pleistocene fluviatile gravel from the Permo-Carboniferous morainic deposits by their *état physique*, except through the artefacts incorporated in the former. In fact, Professor Zeuner points out (below, p. 64) that the reason for this confusion may be that the ancient land-mass was drowned by deposits and the re-deposited gravels were formed on the humps of the Talchir conglomerate. The absence of a fossil-horizon in between may not weaken, as Professor Zeuner is inclined to think, this hypothesis, as the horizon itself might, in the observed places, have been denuded away.

Can there be any chance for some or all of these tools, found on the polygenetic gravels of the glacial moraine, to be freaks formed by natural agencies such as ice? Here the interesting results arrived at by the Abbé Brueil[1] by the study of the effects of glaciation of both pre-human and human age on pebbles call for relevant consideration. The Abbé has pointed out that in some of the South African glacial deposits, which are undoubtedly pre-human, owing to the crushing burden and shifting stresses of the movement of glacial deposits, material that simulates elementary artefacts is produced.

But as far as our region is concerned, this aspect of the problem need not trouble us, as the Pleistocene mantle (re-deposited) gravel was not subjected to any friction as the moraine in deeper parts, and none of the tools shows glacial striae to account for their having been fabricated by ice. In fact, no. 19 (fig. 4; pl. XVII) shows glacial striae only on the big cortical patch and not on the prepared surfaces, which clearly indicates that the striae are earlier in origin than the palaeolithic artefacts. Besides, a close examination of the collected tools shows that they were all made by a very complicated technique producing tool-patterns such as handaxes, cleavers and choppers, and it is very hard to imagine any agency except human for their fabrication.

C. GENERAL CULTURAL ELEMENTS

Palaeoliths were found on the Rewā side of the Baliā Nadī on the eroded surface of the Talchirs and only very few were available on the opposite side of the river within Mirzāpur limits, the alluvial surface of which is at a much lower level and is so younger. Almost all the tools in the collection are made of quartzite excepting three, which are made of vein quartz of milky variety. The artefacts consist of a large series of Abbevillio-Acheulian bifacial handaxes, with a minor assemblage of pebble and core (chopping) tools forming 15 per cent of the collection. The biface tools include a well-represented group of cleavers of many types. Apart from these there are numerous flakes, both real tools and waste flakes, amounting to 50 per cent of the entire collection. Of the good flakes there is a dominant 'proto-Levallois' group forming 18 per cent. There is a further 7 per cent of undoubted Levallois (faceted-platformed) flakes also.

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[1] Abbé Henri Brueil, 'A preliminary survey of work in South Africa', *The South African Archaeological Bulletin*, I, no. 1 (Dec. 1945), pp. 5-7.

D. MEETING PLACE OF THE 'SOHAN' AND 'MADRAS' INDUSTRIES

Movius has pointed out that the Sohan, Choukoutienian and Patjitanian form the western, northern and southern frontiers of the 'chopper-chopping tool' culture area, with its focus in the Burmese Anyathian.[1] As the Singrauli basin lies medially on the Sohan-Anyathian axis, can it be that the industry of this region was influenced by this Sohan 'chopper-chopping' tool-complex, especially when we have observed a minor assemblage of pebble tools forming about 15 per cent and recalling typologically such a culture-complex ?

Movius has analyzed this tool-complex into the 'choppers, chopping tools, hand-adzes, and proto-handaxes'. According to this terminology, our pebble tools consist of about eight 'choppers', many of them recalling Early Sohan prototypes, and about half-a-dozen 'chopping tools', these having been made both on pebbles and on cores. Thus, out of the pebbles we have a couple of rostro-carinate-like tools, a few alternately jagged-edged pebble 'chopping tools' and some small Early Sohan choppers. Among the cores there are a few 'chopping tools' with a W-like working-edge along a portion of the periphery. Apart from these, there is a specimen of a 'proto-handaxe'. Hand-adzes are totally absent in our collection.

The coups-de-poing are of the Abbevillio-Acheulian series, consisting of free-flaked pyriform handaxes, ovates and long round-butted evolved Acheulian tools exhibiting controlled flaking all over and with a tongue-shaped business-end. Some of the Acheulian types are made on Attirampakkam (Vaal) technique. Three of the exceptional quartz coups-de-poing in the collection are rolled.

Besides, there are cleavers which are of the straight-edged round-butt type, oblique cutting-edged type and triangular pointed-butt type, many of them employing the Attirampakkam (Vaal) technique. The handaxes and cleavers together form 43 per cent (35+8) of the collection and bear close typological affinity to the Madras industry.

Finally, there are a few cores, also bifacial in character, all of which belong to the Clactonian technique and comprise biconical, discoid and spindle types. A few of them conform to certain tool-types such as scrapers. Thus, though the 'chopper-chopping tool' (Sohan) complex had influenced the Singrauli industry, the dominant phase here was a bifacial one and therefore akin to the Madras industry.

The following table shows the number and percentage of the main palaeolithic types in the collection.

Type of implement	*Total*	*Percentage*
'Chopper-chopping' tool	17	15·5
'Hand-adzes'	...	...
'Proto-handaxe'	1	0·9
Handaxes	38	34·5 } 42·7
Cleavers	9	8·2
Cores and core-scrapers	8	7·3
Levallois flakes	8	7·2
'Proto-Levallois' flakes	20	18·2
Miscellaneous Clacton flakes (waste flakes excluded) ...	9	8·2
Total ...	110	100·0

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[1] H. L. Movius, Jr., 'Early man and Pleistocene stratigraphy in southern and eastern Asia', *Papers of the Peabody Musuem of Archaeology and Ethnology* (Harvard Univ., Camb. Mass.), XIX, no. 3; 'The Lower Palaeolithic cultures of southern and eastern Asia', *Trans. Amer. Philos. Soc.*, N. S., XXXVIII, pt. 4.

E. STATE OF PRESERVATION OF THE TOOLS

Owing to the absence of evidence for any stratigraphic relationship of the pebble tools with the bifaces it is not possible to say which of the two was earlier in the Singrauli basin. At the same time, due to the fact that the former are found in association with the latter it can be said that both of them belong to the early Palaeolithic stage. An examination of the collection shows that the pebble tools look comparatively more worn than the bifaces, many of the latter having an almost fresh appearance. Hence it is possible that the pebble-group may be older in age than the bifaces, purely on the basis of their *état physique*.

F. 'PROTO-LEVALLOIS' FLAKES

Let us consider now the nature of the flakes in the collection. In the majority of cases, the striking platform is plain and unifaceted and the flaking angle generally ranges from 90° to 125°. But nearly 70 per cent of the good flakes, on goniometric analysis, were seen to have flaking angles ranging from 90° to 105° only. Further, there is some kind of preparation of the flakes in this group, comprising nearly 18 per cent of the collection, and some of the flakes exhibit a battered instead of a truly faceted platform and with flaking angles of roughly 90°. All these would point towards a 'proto-Levallois' flaking technique. Besides, true Levallois tools are also present, forming roughly 8 per cent of the lot, and a remarkable feature is a nosed end-scraper on a Levallois flake showing nibbled retouch, which should be ascribed to the Upper Palaeolithic on purely typological grounds. The 'proto-Levallois' and the true Levallois flakes comprise together about 26 per cent of the collection, and this would definitely reinforce the conclusion already arrived at on the basis of pebble tools that the Sohan tradition is clearly apparent in the Singrauli lithic industry in the same manner as it is present in the Potwar area in the Panjab.

Thus, the best that can be said about the Singrauli lithic industry is that it represents an essentially Abbevillio-Acheulian (bifacial) core-industry and is influenced by the Sohan (Levallois) flaking technique. The industry may be safely ascribed to the mid-Pleistocene period, as a similar cultural association was proved to belong to the mid-Pleistocene by De Terra on palaeontological grounds in the Narmadā which lies as far south near the Tropic of Cancer as Singrauli basin is to the north of it.

G. LINK BETWEEN SINGRAULI AND MAYŪRBHANJ INDUSTRIES

Having pointed out that the dominant industry of the Singrauli basin is a bifacial core-industry, attention may be drawn to the discovery in Mayūrbhanj (Orissa) of an overall bifacial industry, prevalent in the basins of the Swarṇarekhā and the Śankh,[1] the headwaters of which are hardly 200 miles south-west of the Rihand. Possibly there are many unrecorded palaeolithic sites to be linked between these two regions by a thorough exploration. The similarity of the quartzite industry of both these areas is shown in the bifacial tool-types such as Abbevillio-Acheulian coups-de-poing, various cleaver-types and scrapers on cores and Clactonian flakes. At the same time there appears a certain amount of development in the Singrauli industry over the Mayūrbhanj one, in which region progress is considered to have been slow and spread over a fairly long period.

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[1] Bose and Sen, *op. cit.*

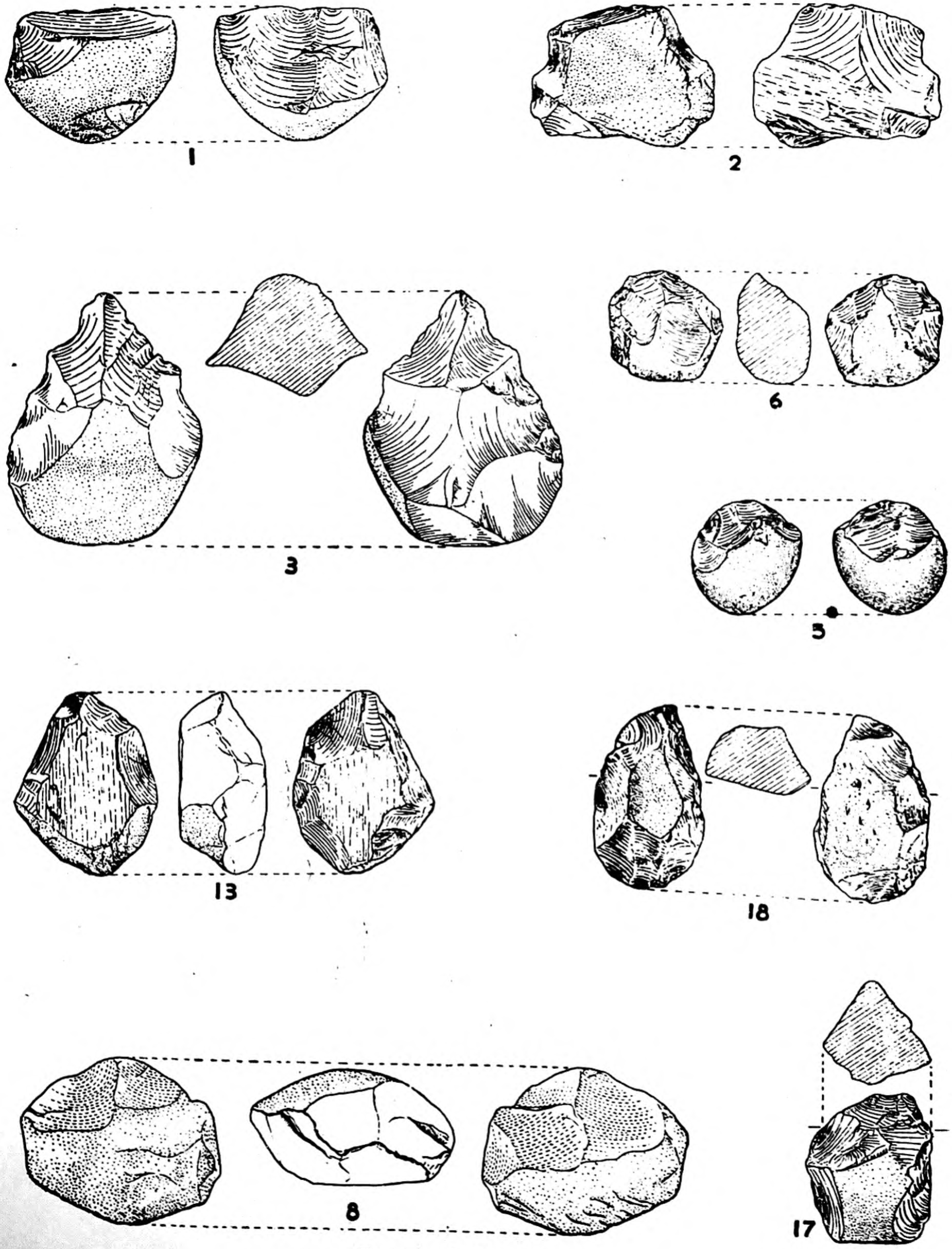
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FIG. 3. *Pebble tools.* ½

Perhaps the Singrauli tool-makers were initially vitalized by the Mayūrbhanj bifacial industry and advanced at a faster rate than their inspirers, owing to the influence of the Sohan technique which gave a stimulus to the flaking capacity. This is clearly borne out by the nature of the flake tools in the Singrauli basin as investigated.

H. DESCRIPTION OF THE PALAEOLITHS

(*i*) *Pebble tools* (*fig.* 3 ; *pl. XVI*)

These are eighteen in number and consist of both primitive as well as advanced choppers and chopping tools and scrapers of the Sohan type. The material in all cases is close-grained grey and brown quartzite.

1. *Primary flaking.*—This is a split-pebble tool, with a flat upper cortical surface and roughly flat underside formed by a few irregular flake-scars. Three-fourths of the periphery is steeply flaked. The tool is a 'chopper', the edges of which show battering due to use. Found *in situ* in the gravel-section at Locality II.

Secondary working.—None.

Name and age.—Pebble chopper ; Early Sohan.

2. *Primary flaking.*—The implement is made on a broken pebble from which, by unifacial free-flaking using the natural plane-surface on one side as striking platform, a wavy edge is obtained almost across the length of the pebble. This tool was *in situ* in the derived gravel-section in Locality II. The sinuous working-edge shows signs of use.

Secondary working.—None.

Name and age.—Pebble chopper ; Early Sohan.

3-4. *Primary flaking.*—These are pointed rostro-carinate-like digging tools with roughly flattish ventral side formed by the removal of a few big flakes struck from either margin, and the dorsal side has a medial ridge with flakes removed towards the hump from the margin and merging with the cortical butt-surface. While in the case of no. 3 the pebble cortex is retained on half of the dorsal side, in no. 4 it is patchy in the butt, and the tool is flaked all around and has a flatter ventral side than no. 3. Still no. 3 is a better-flaked tool, and apart from the flaking on the dorsal side two more small flakes on the ventral surface removed from either side of the tip have bestowed the tool with a particularly efficient tip for picking.

Secondary working.—Little or none.

Name and age.—Pebble tool ; Early Sohan.

5. *Primary flaking.*—This is a pebble tool having the cortical surface for the greater part of the pebble as the butt end trimmed by alternate flaking resulting in a semi-equatorial wavy working-edge. There are eight (5-12), three of medium size and the remaining four small, of this type of choppers which recall their Sohan prototypes.

Secondary working.—Practically none, though the tools show signs of battering, due to use.

Type and age.—Pebble choppers ; Early Sohan.

13. *Primary flaking.*—There are three tools of this type (nos. 13-15). This is a core chopping tool made on a flat block of stone and is bifacially chipped. In all the cases the edge or part of the edge thus produced is markedly sinuous forming a broad W-shaped edge since it is worked by the intersection of alternate flake-scars. They show battering and considerable signs of use.

Secondary working.—Little or none.

Type and age.—Pebble chopping tools ; Early Sohan.

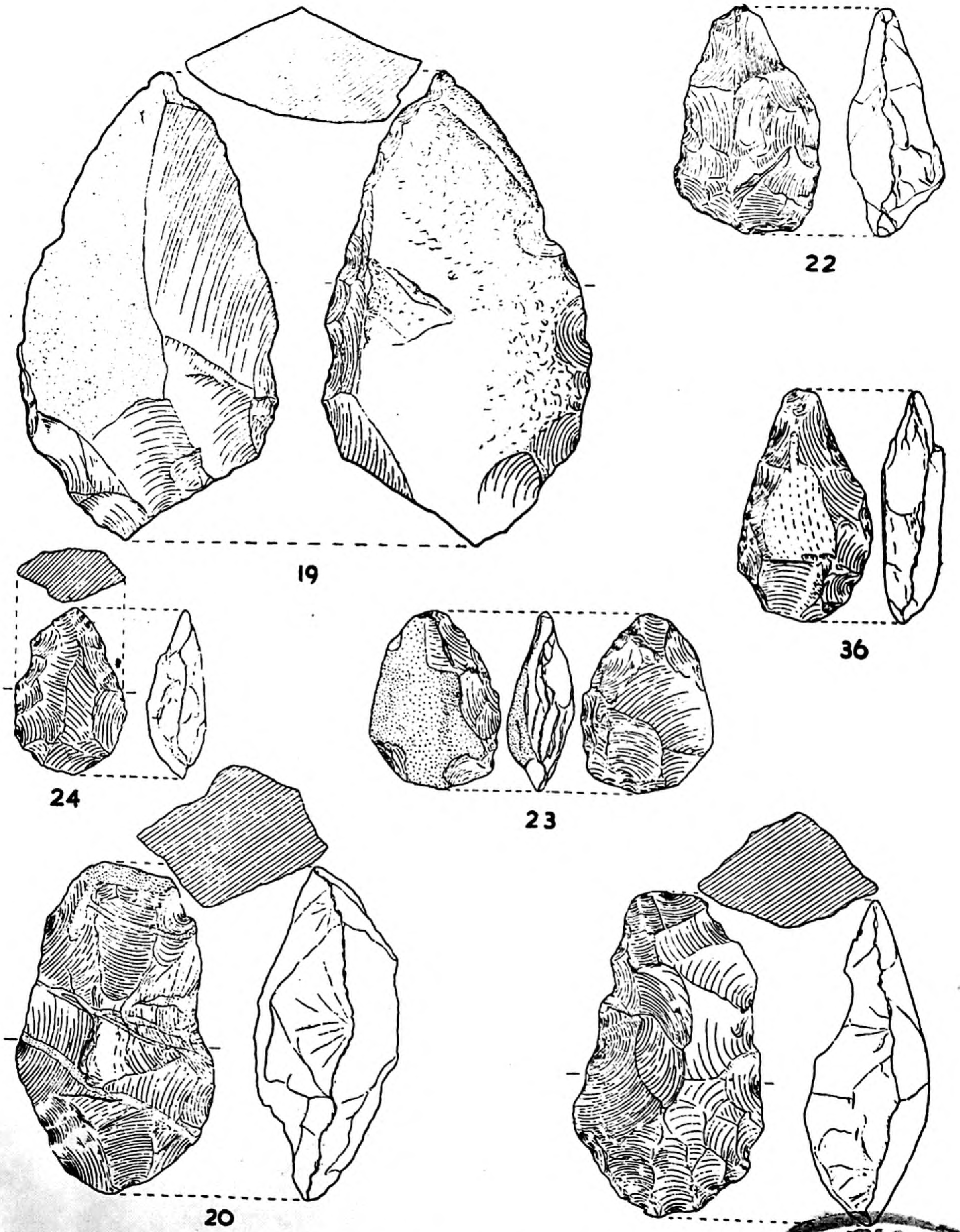
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Fig. 4. *Abbevillio-Acheulian handaxes.* ⅓

GOVT GIRLS COLL
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18. This is a crude pear-shaped-tool with a flat underside resulting from flat flaking. and with the upper side steeply flaked around leaving a central ridge. The margin is steeply flaked only on the upper side using the ventral flat surface as platform resulting in a roughly plano-convex cross-section. This tool may be taken as representing Movius' 'Proto-handaxe'[1] and as typologically transitional between the pebble chopping tools and the bifacial coups-de-poing.

(ii) *Handaxes, ovates and cleavers* (*figs.* 4-6 ; *pls.* XVII-X)

Of these, the handaxes and ovates are thirtyeight in number (19-57) and consist of a crudely finished group (19-44) and a well finished group (45-57), big and small. Excepting three of them, which are made of dyke quartz, the material is throughout generally grey quartzite. The Abbevillio-Acheulian series of bifaces is completely and admirably represented in the collection.

HANDAXES.—**19.** *Primary flaking.*—One of the outstanding specimens in this series is a giant handaxe of red sandstone nearly 10 in. × 5 in. and with a thickness at the butt of approximately 4 in. It has a pointed business-end and a heavy body and is typical of a free-flaking stone technique. It is a flake tool with a primary flake-surface on the underside. On the upper side there is a cortical patch on one half and a single negative flake-scar creates the opposite margin. The cortical patch exhibits glacial striae, the material being a morainic boulder.

Secondary working.—None.

Type and age.—Early Abbevillean handaxe.

20. *Primary flaking.*—This is a heavy thick tool, with a parallelogram cross-section, obtained by free flaking along the margin. There are veins of white quartz running across the breadth of the brown material of the tool.

Secondary working.—None.

Type and age.—Late Abbevillean handaxe.

21. *Primary flaking.*—The tool, rhomboidal in cross-section, has a heavy butt-end with the underside exhibiting a smooth convex primary flake-surface formed by a single stroke. The tool thins down towards the working-end to a square cutting-edge instead of a tip.

Secondary working.—None.

Type and age.—Late Abbevillean handaxe.

22. *Primary flaking.*—Medium-sized handaxe, with a pointed tip and with a low mid-rib present on both sides, the cutting-edges along the margin obtained by alternate flaking.

Secondary working.—Slight secondary step-flaking along the margin.

Type and age.—Early Acheulian handaxe.

23. *Primary flaking.*—Short, pear-shaped tool made on a cortical flake, the ventral flake-surface of which shows much marginal trimming by step-technique.

Secondary working.—Step-flaking along the edge to straighten and sharpen it.

Type and age.—Early Acheulian handaxe.

24. *Primary flaking.*—The smallest of the handaxes (2½ in. × 1½ in. × 1 in.), of bluish quartzite. A core tool with large flake-scars on both sides and with a jagged free-flaked butt-end. Has sharp sides and pointed tip.

Secondary working.—Only near the tip-end, making it thin and pointed.

Type and age.—Coup-de-poing ; mid-Acheulian.

30. *Primary flaking.*—A scalene triangular tool with the ventral side almost flatly worked and with the dorsal right margin as the working-edge. The tip is pointed. The tool is very much rolled.

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[1] Movius, *op. cit.* (1944).

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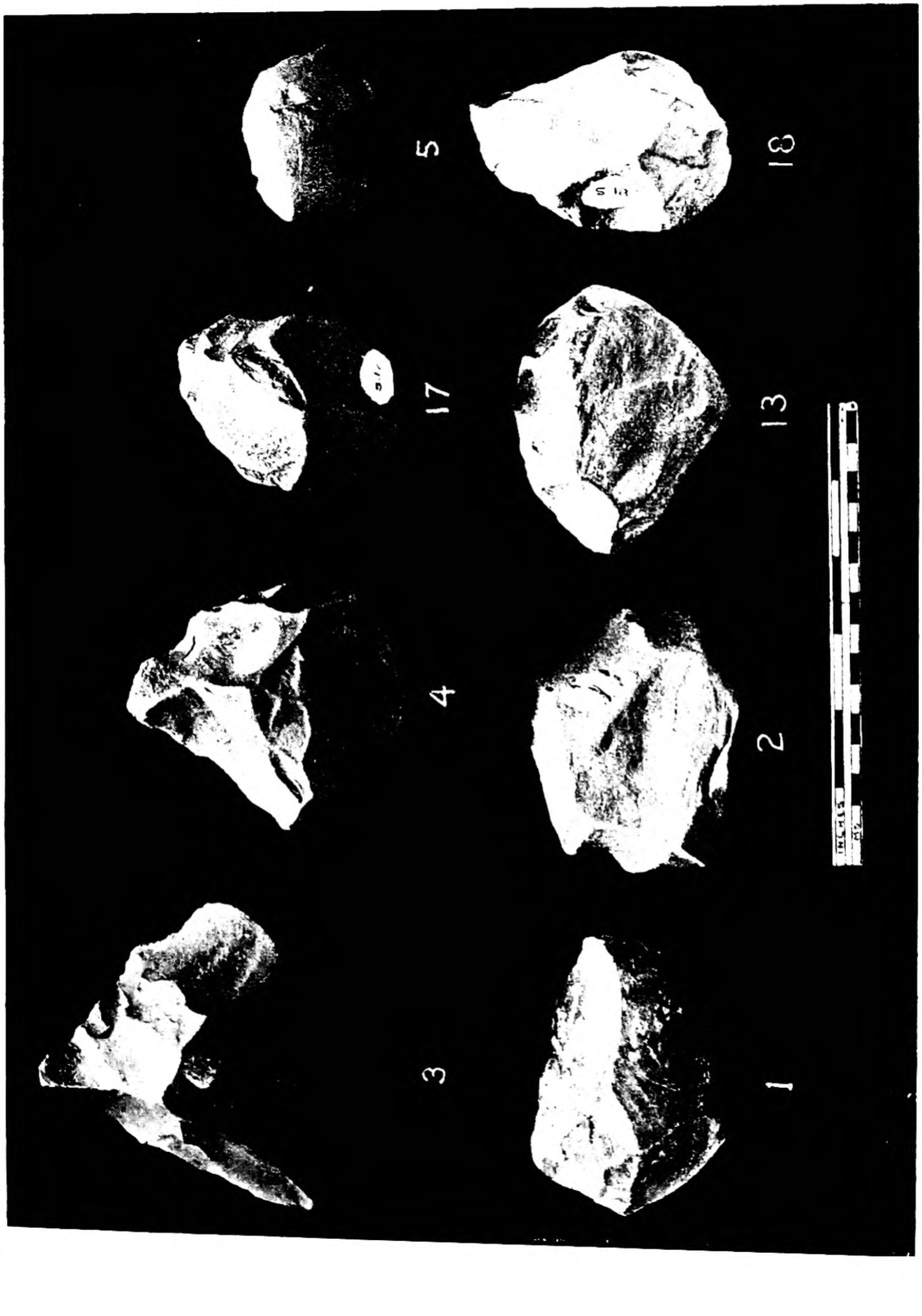
PLATE XVI



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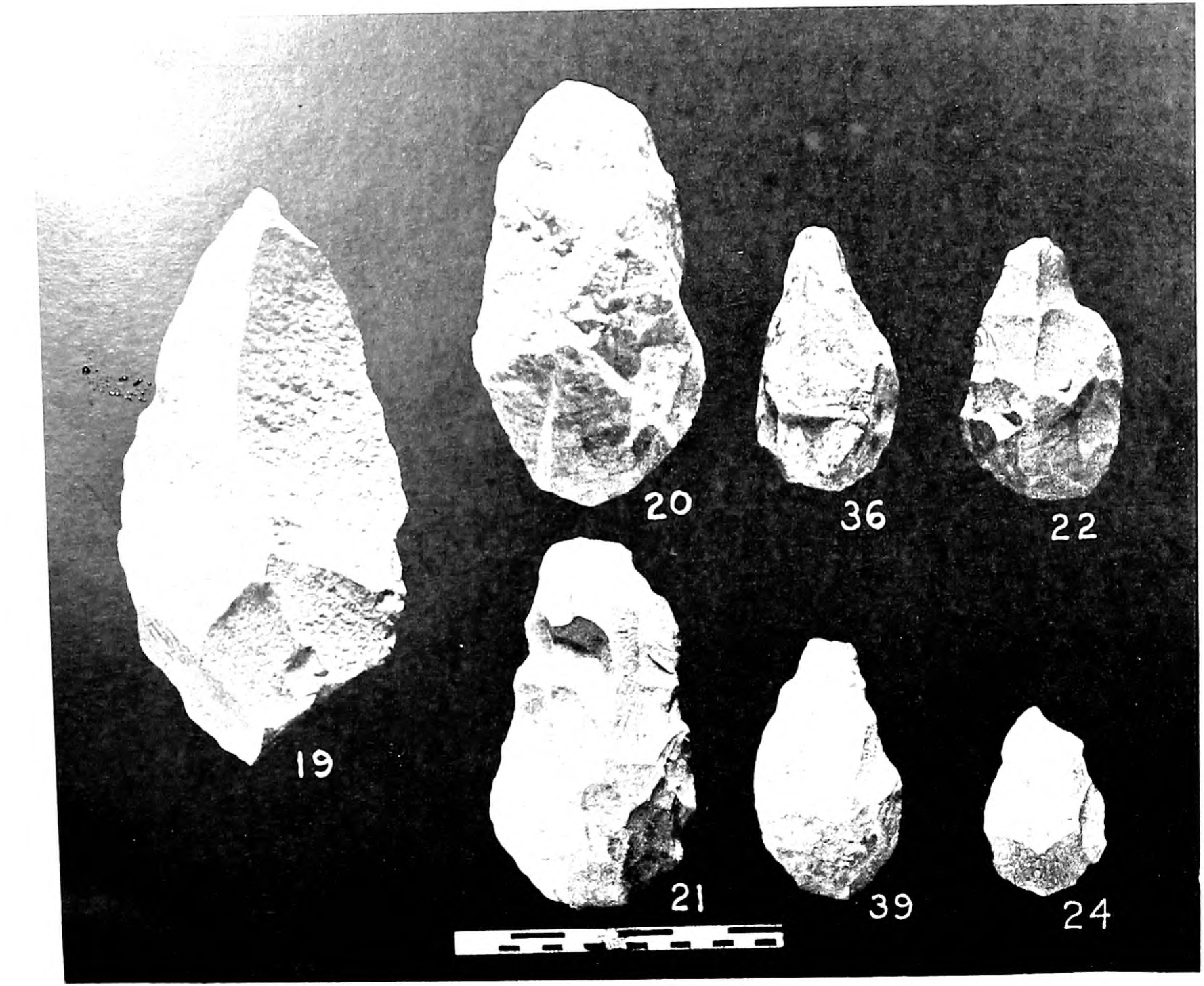
Pebble tools (see pages 50–52)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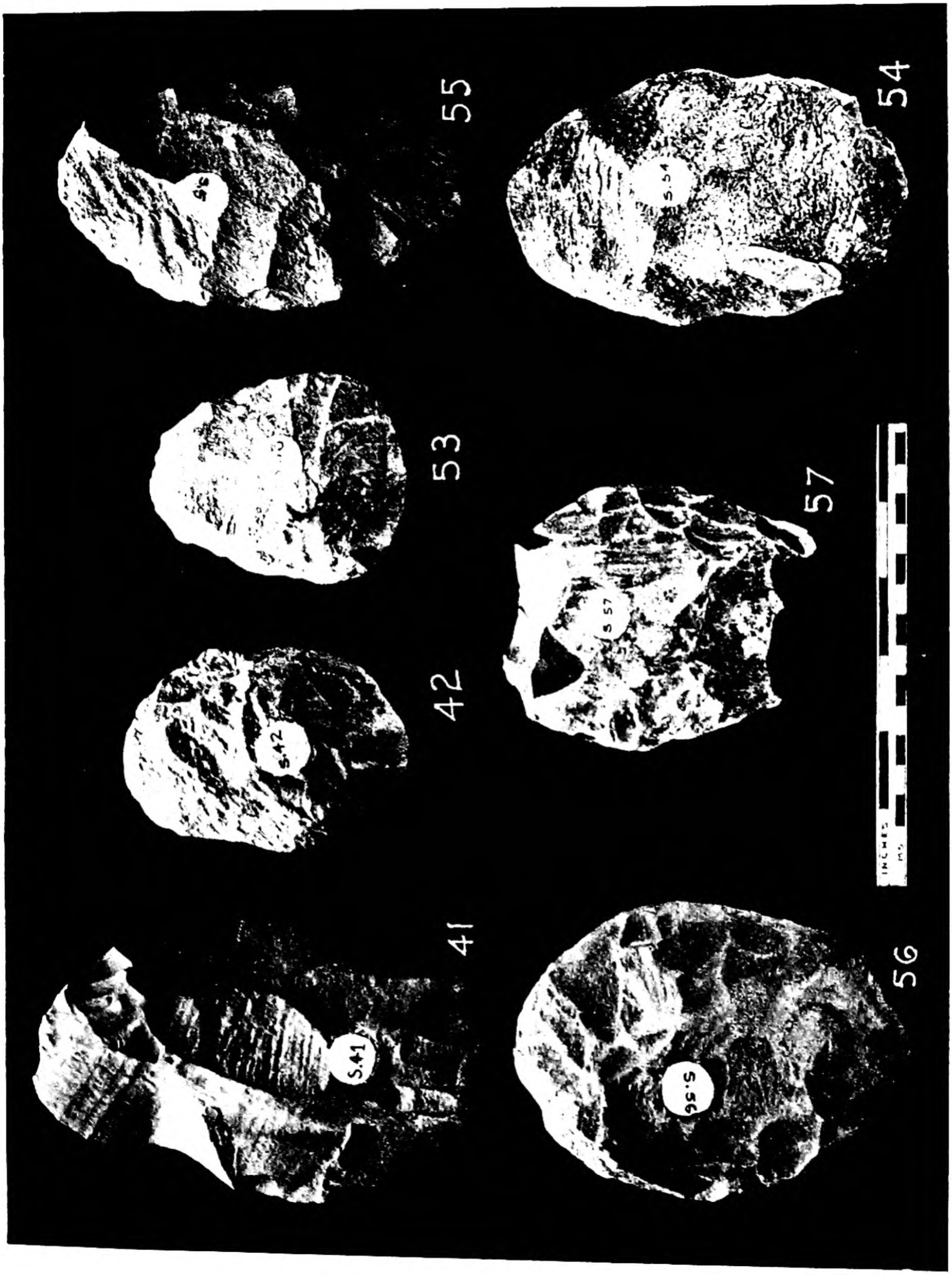
Abbevillian-Acheulian tools (see page 52)

To face plate XVII

PLATE XVIII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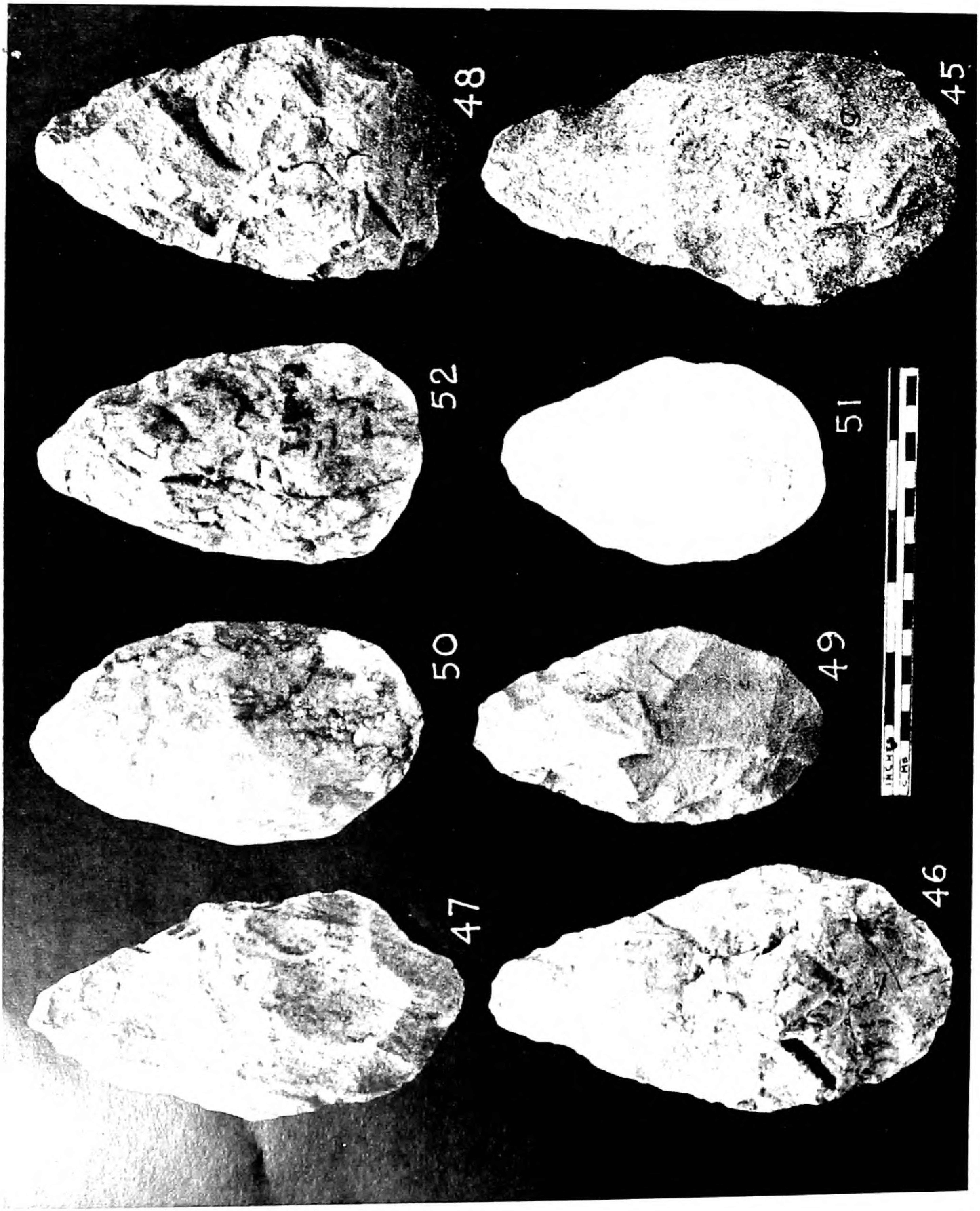
Oates (see pages 54–57)

PLATE XIX

To face page 53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Acheulian coups-de-poing (see page 54)

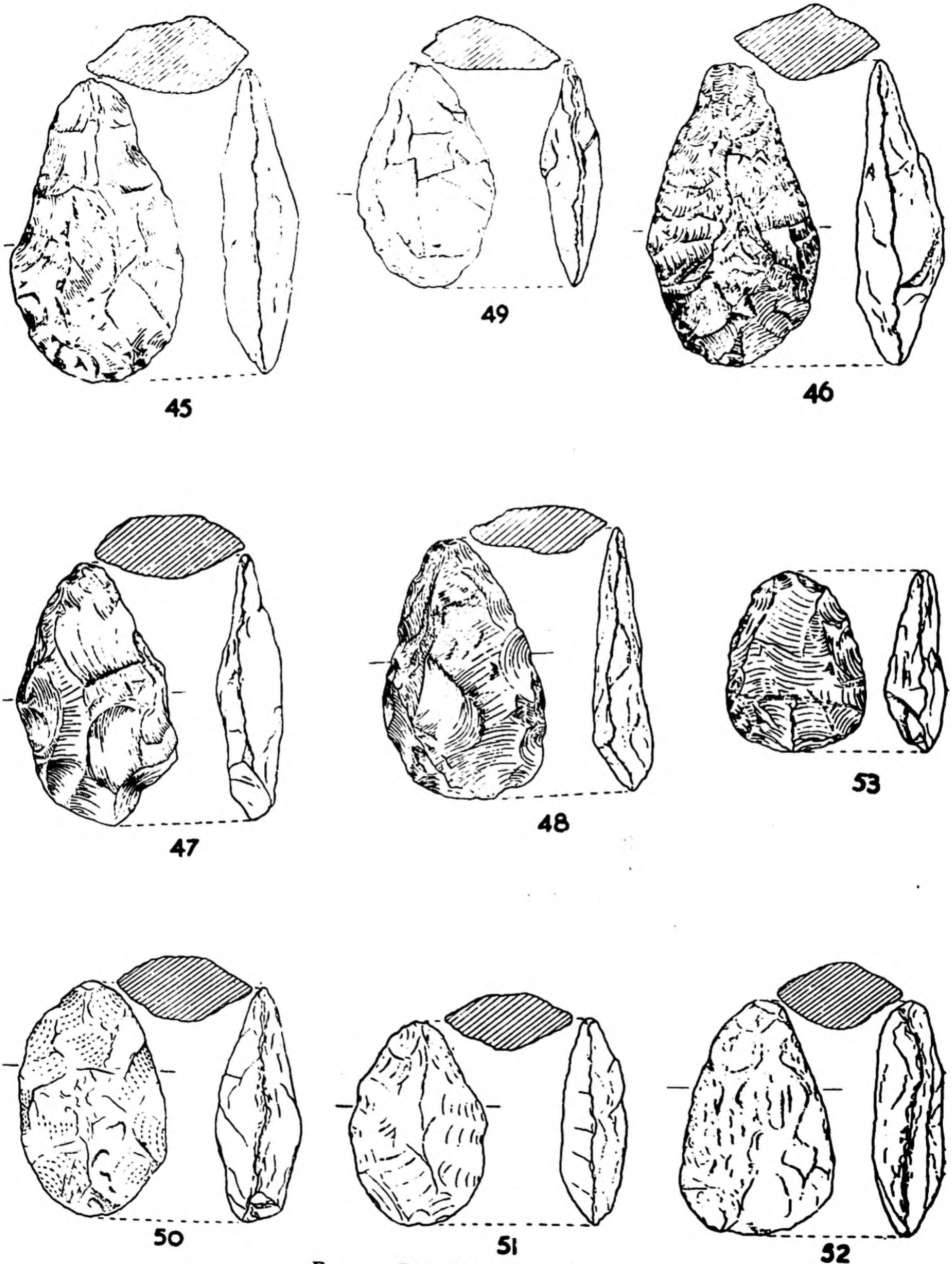
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FIG. 5. *Evolved Acheulian tools.* $\frac{1}{3}$

Secondary working.—None.

Type and age.—Late Abbevillean handaxe.

43. *Primary flaking.*—Of the better-finished bifaces this is a tool made on a cortical flake but with the pebble-surface secondarily worked out except near the butt. The underside is a concave flake-surface.

Secondary working.—By profuse secondary chipping and step-flaking technique sharp knife-edges are obtained on either margin and the tip of the tool itself is thin and pointed.

Type and age.—Handaxe ; mid-Acheulian.

44. *Primary flaking.*—Small flake tool with pointed tip, carefully-trimmed sides and thin cross-section.

Secondary working.—Step-flaking employed to straighten the edges.

Type and age.—Handaxe ; mid-Acheulian.

EVOLVED ACHEULIAN TOOLS.—There are eight well-executed coup-de-poing specimens (nos. 45-52) of the evolved Acheulian stage, of which no. 44 is made on arkose, no. 45 on dirty chert with a geode of quartz-crystals, no. 46 on felspathic paragneiss (a rare material in the palaeolithic industry) and nos. 50-52 on white dyke quartz. All of them are pyriform handaxes in which the sinuous rim has given place to a sharp straight cutting-edge due to secondary chipping on the sides and along the margins.

45. *Primary flaking.*—Core tool on arkose (a rare material), flaked and trimmed on both sides, mostly feather-edge, but some resolved flaking too apparent close to the periphery. The butt-end is carefully rounded and the tip-end is flattened tongue-like.

Secondary working.—The edges are made straight and sharp by step-flaking, following wood-technique.

Type and age.—Coup-de-poing ; middle Acheulian.

46. *Primary flaking.*—Core tool on very difficult dirty cherty material, fractured across and with a geode of quartz-crystals. Trimmed on both sides, with feather-edge flaking and resolved flaking as in no. 45 and having a biconvex cross-section.

Secondary working.—Step-flaking employed to make the edges straight and sharp.

Type and age.—Coup-de-poing ; middle Acheulian.

47. *Primary flaking.*—Sharp pear-shaped core tool on felspathic paragneiss, the rarest material preserved in the palaeolithic industry, worked dexterously on both sides with controlled flaking. The tool thins down towards a pointed tip.

Secondary working.—Edge straightened by step-flaking technique.

Type and age.—Coup-de-poing ; middle Acheulian.

48. *Primary flaking.*—A thin pear-shaped tool, on green laminated quartzite looking like trap ; similar to the previous specimens in working.

Secondary working.—Feather-edge and step-flaking employed.

Type and age.—Coup-de-poing ; middle Acheulian.

49. *Primary flaking.*—Thin pear-shaped flake tool, exhibiting flat, smooth cortical surface on the ventral side. The dorsal surface has slightly swelling central portion. The butt-end is sharp and well-rounded, and the tip, though broken, is also sharp.

Secondary working.—Edges exhibit step-flaking all round.

Type and age.—Coup-de-poing ; middle Acheulian.

50-52. *Primary flaking.*—Of these three handaxes made in dyke quartz, nos. 50 and 51 have an ovoid form with a thick cross-section and no. 52 is a triangular-shaped tool. All the three are heavily rolled. Considering the *état physique* they may be earlier than the rest of the Acheulian coups-de-poing.

Secondary working.—Resolved flaking employed in shaping the tools.

Type and age.—Coups-de-poing ; middle Acheulian.

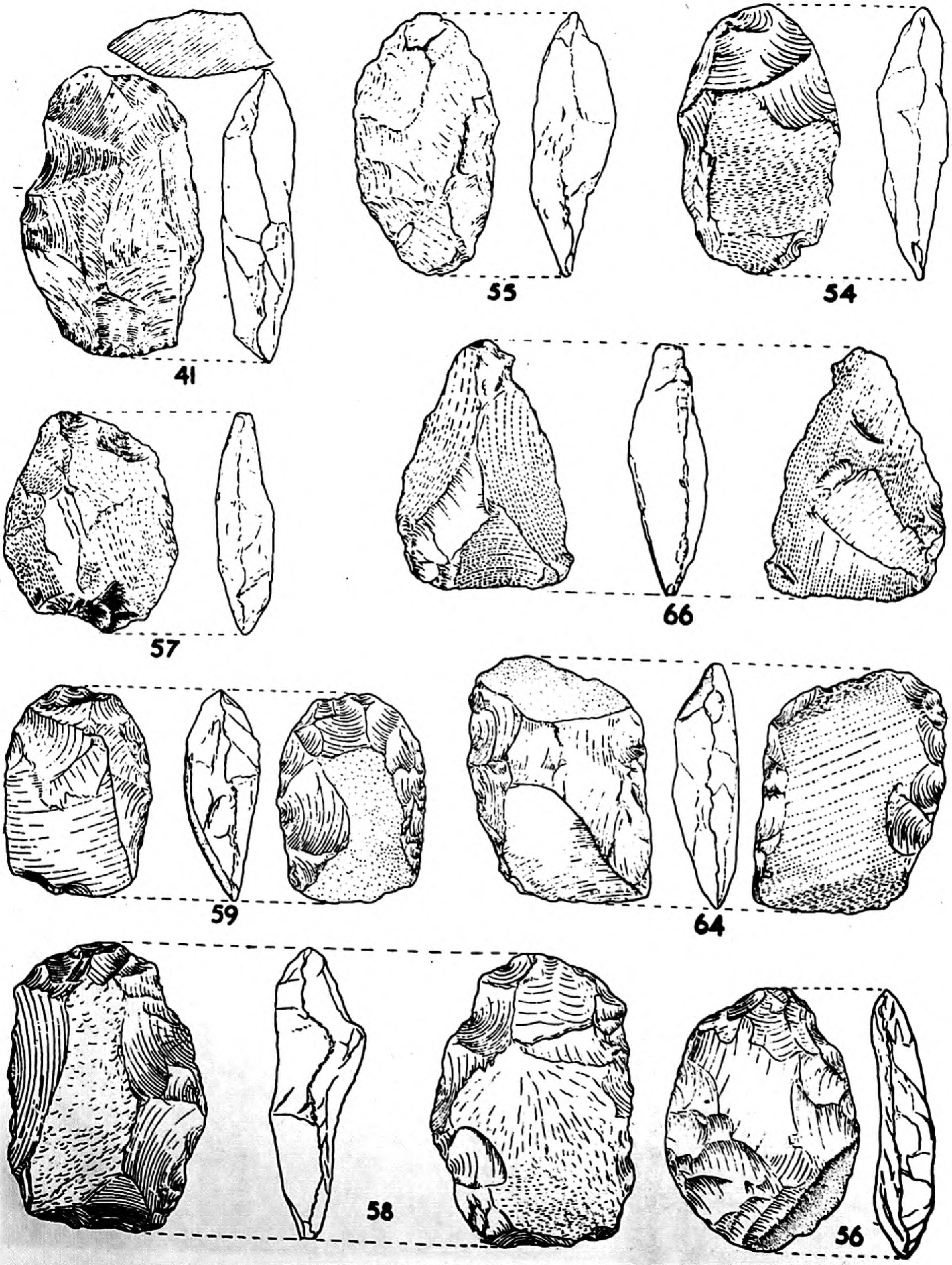
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FIG. 6. *Ovates and cleavers.* ½

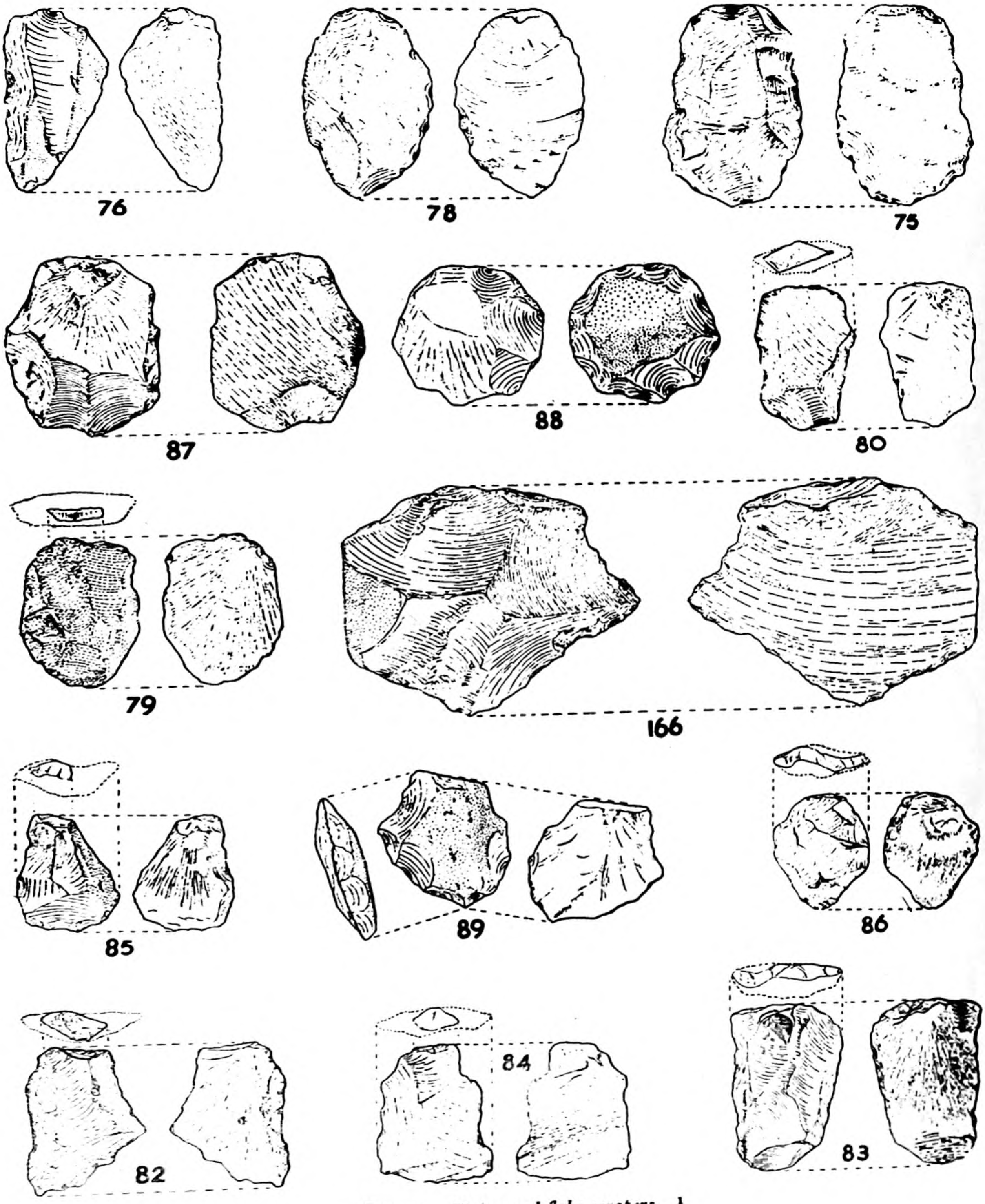
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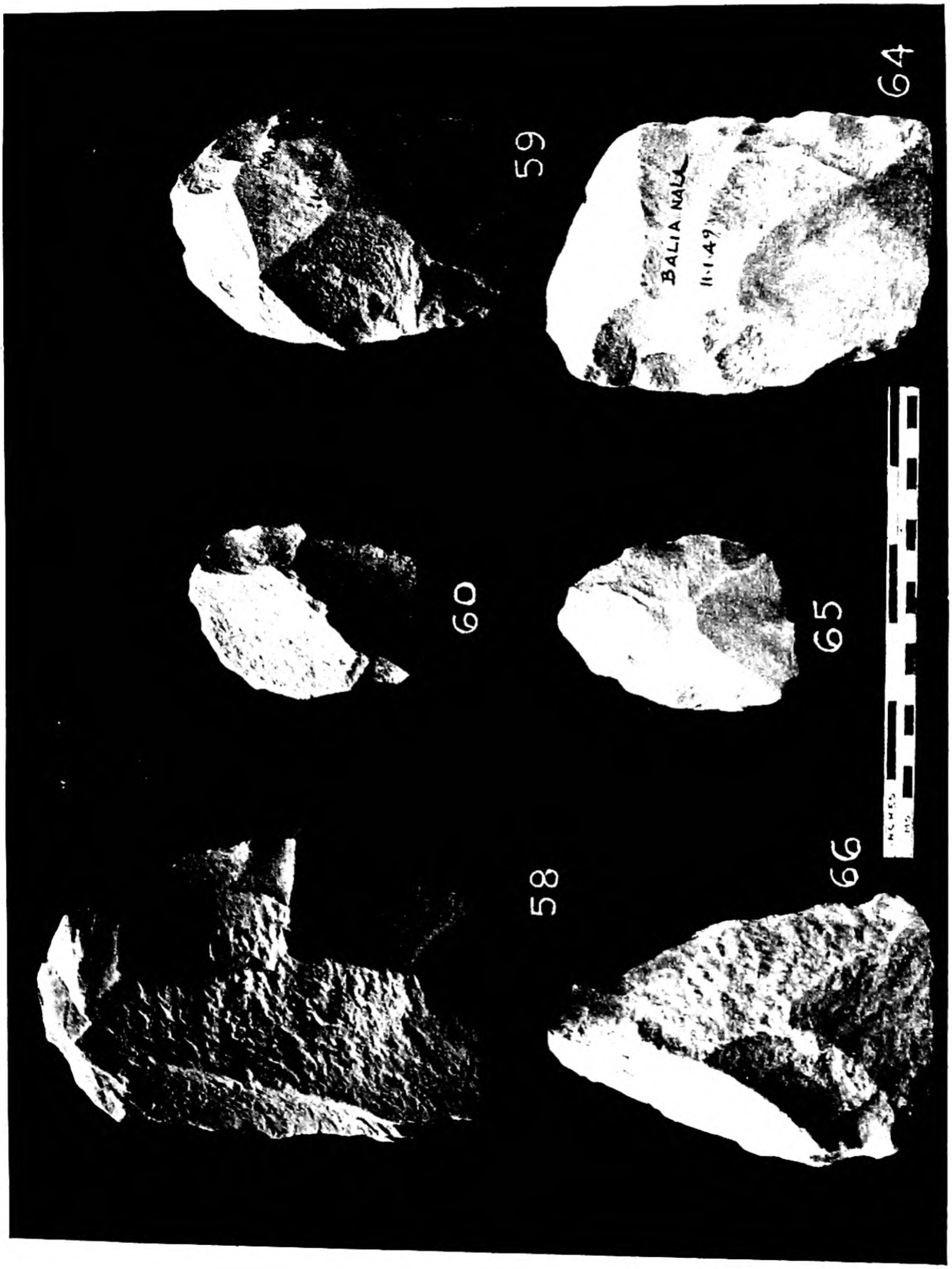
FIG. 7. *Flakes and flake-scrapers.* ⅓

To face page 56

PLATE XX



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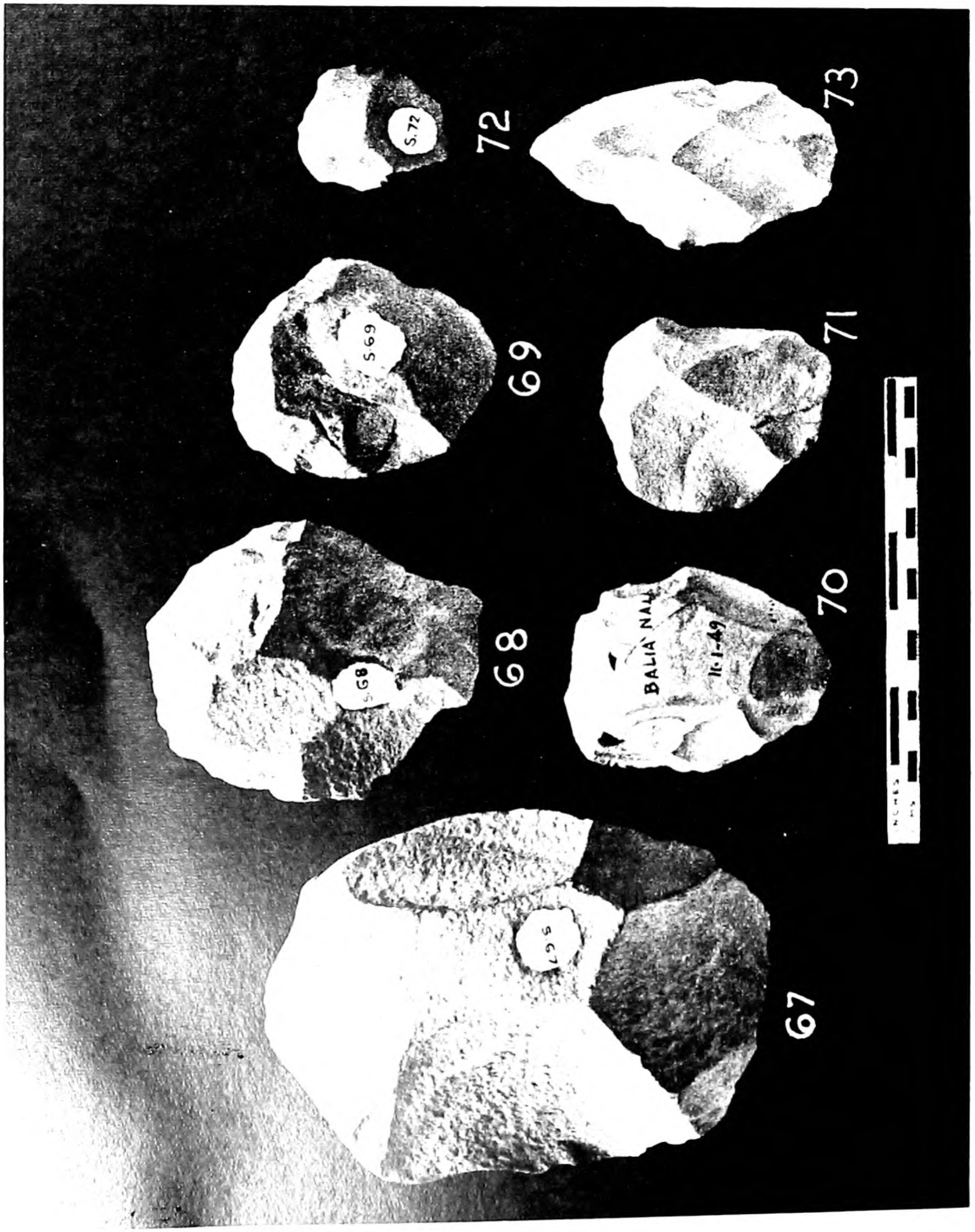
Cleavers (see pages 57–58)

To face plate XXII


67
S.67
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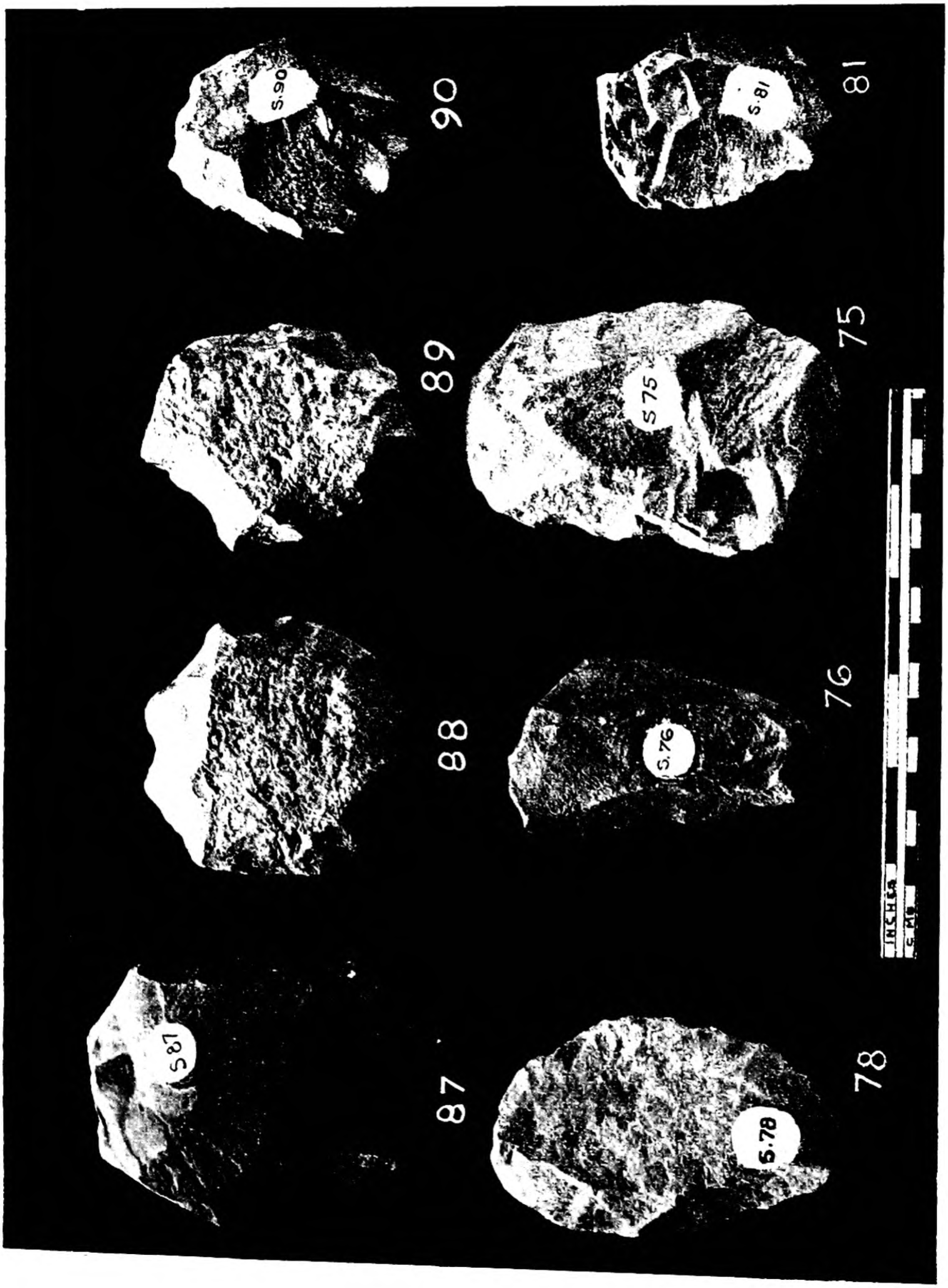
Cores (see page 58)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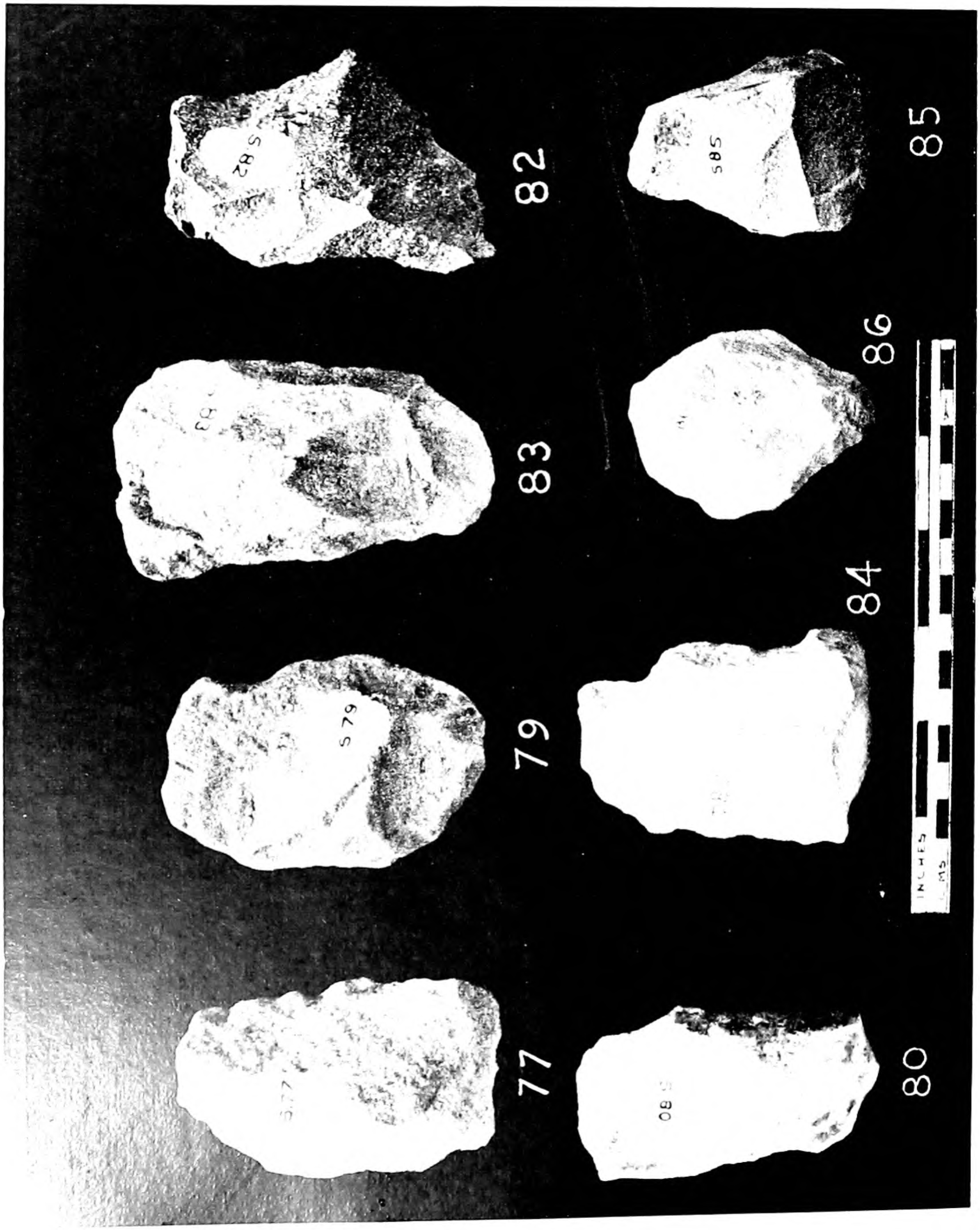
Flakes and flake-scrapers (see page 58)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INCHES

Levallois flakes (see page 58)

53. *Primary flaking.*—Small, neat, broad, ovo-pear-shaped handaxe (3 in. × 2 in. × ¾ in.), prepared by resolved flaking. Near the butt-end there is a veinlet of white quartz running across the width of the tool.

Secondary working.—Step-flaking employed all round the edges.

Type and age.—Coup-de-poing ; middle Acheulian.

OVATES.—There are four advanced ovate handaxes in three of which (nos. 54 to 56) Attirampakkam (Vaal) technique on flakes has been employed.

54. *Primary flaking.*—Flake ovate on arkose, like no. 45, is prepared by Attirampakkam (double Vaal) technique and is almost a cleaver, with broad cutting-edge instead of a pointed tip. The specimen is much weathered.

Secondary working.—Steep-ended flaking along one edge, the opposite sharp edge being the meeting of the two primary flake-surfaces.

Type and age.—Ovate handaxe ; middle Acheulian.

55. Almost similar to 54 but without a cleaver-edge.

56. *Primary flaking.*—This is again a flake ovate which has a thin cross-section all along, a concave ventral primary flake-surface produced by Attirampakkam (single Vaal) technique and a smoothly-chipped dorsal side.

Secondary working. –Resolved flaking, more apparent on the ventral surface along the edge.

Type and age.—Ovate handaxe ; middle Acheulian.

57. *Primary flaking.*—This is an ovate tool on black flint, patinated to a dull cream colour with the top and bottom edges broken, exposing the flint (perhaps accidental, due to cattle-movement). The tool is flatly chipped all over the dorsal and ventral surfaces and has a sharp margin all around. It is flat biconvex in cross-section.

Secondary working.—Resolved and feather-edge flaking employed to smoothen the sides and to get sharp edges.

Type and age.—Ovate handaxe ; middle Acheulian.

CLEAVERS.—These are nine in number (nos. 58-66), representing all the three types of cleavers, on core and flake, viz., the semi-circular or flat-butted ones with a straight cutting-edge (nos. 58-63), the asymmetric cleaver with an oblique cutting-edge (nos. 64-65) and a triangular-shaped cleaver with the straight edge (no. 66).

58. *Primary flaking.*—This is the biggest specimen (6 in. × 4 in. × 1¾ in.) among the cleavers and has an almost flat dorsal side with high peripheral chipping from the margin towards the centre. On the ventral side, one broad smooth negative flake-scar roughly halfway down results in a sharp cleaver-edge by meeting the prepared dorsal surface. The technique employed is the Attirampakkam (Vaal) technique. The tool shows great signs of use.

Secondary working.—Little or none.

Type and age.—Cleaver ; middle Acheulian.

59. *Primary flaking.*—This is an exquisitely-made core cleaver with the business-edge resulting from the meeting of the dorsal cortical surface with the smooth primary flake-scar on the ventral side, employing Attirampakkam (Vaal) technique. The tool has a biconvex cross-section.

Secondary working.—The edges are all chipped by resolved flaking, and the butt-end is carefully rounded.

Type and age.—Cleaver ; middle Acheulian.

60-63. Similar straight-edged types as above.

64. *Primary flaking.*—This is a 'guillotine type' of cleaver with the dorsal side having a centrally-flat pyramidal ridge formed by the convergence of marginal flake-scars and with a single primary flake-scar on the ventral side, the meeting of the two resulting in an oblique cleaver-edge.

Secondary working.—Little or none.

Type and age.—Cleaver ; middle Acheulian.

66. *Primary flaking.*—This is the only specimen with a triangular shape, a straight cleaver-edge and a pointed butt.

Secondary working.—Little or none.

Type and age.—Cleaver ; middle Acheulian (?).

(*iii*) *Cores* (*pl. XXI*)

The cores all belong to the Clactonian technique and comprise the biconical, discoidal and spindle types. They are eight in number.

67. This is a huge crude ellipsoidal Clacton core 6 in. × 5 in. × 4 in. in dimensions made by stone technique. Broad steep alternate flakes removed from the margin along the periphery make the edge sinuous.

Type and age.—Early Clacton core ; middle Acheulian.

68-69. These are similar to no. 67 in technique and biconical in shape, but no. 68 has unusually fresh flake-scars and a sharp edge.

70-72. These are flattish discoidal Clacton cores as compared with the previous group. Nos. 70-71 look rather rolled in appearance. No. 72 is a tiny biconical core, roughly 2 in. × 1½ in. × 1 in., which has an equatorial jagged edge due to alternate flaking and has one side retaining a central cortical patch. The tool is typically Sohan and is probably a scraper.

Type and age.—Core-scraper ; Sohan.

73-74. These two are spindle cores, of which no. 73, made of cherty material, has a twisted margin due to successive flaking by turning it around the long axis.

(*iv*) *Flake tools* (*fig.* 7 ; *pls. XXII-XXIII*)

There are seventyfive flakes in the collection, many of which are unspecialized waste flakes. A majority of flakes has plain (Clactonian) platform. On an average the flakes are 3 in. in length and their physical condition is fairly fresh, though there are a few rolled specimens.

75-81. (Proto-Levalloisean flakes). *Primary flaking.*—The best of this group, nos. 75-81, are flakes with a bladish aspect, very clear in nos. 76, 77 and 80. Nos. 77 and 81 show the battering of the edges due to usage. Nos. 78 and 79 are fairly rolled. The striking angles are round about 90° in all cases, and no. 80 shows a battered instead of a prepared platform.

Secondary working.—Little or none.

Age.—Middle Acheulian.

82-86. (Levallois flakes). *Primary flaking.*—These are true Levallois flakes with prepared platforms with their opposite edges bearing secondary trimming, turning the flakes into scrapers. Nos. 85 and 86 are noteworthy examples of 'nibbled' retouch. No. 86 is a nosed end scraper and is typologically Upper Palaeolithic (Aurignacian ?). No. 85 is a broad convex scraper. No. 84 is a scraper where the secondary trimming of the lower edge is steep, almost 90°.

Age.—Middle Acheulian, or probably later.

87-90. Mostly discoidal (tortoise) scrapers. *Primary flaking.*—No. 87 is crude on a clumsy flake. No. 88 is fairly circular scraper rather rolled and prepared both on the ventral and dorsal surfaces. No. 89 is thinly patinated into a grey colour and with edges showing steep retouch useful for scraping. No. 90 is the finest of the group with preparation complete all over and with a sinuous edge useful for either chopping or scraping.

Type and age.—Discoidal (Levallois) scraper-cum-chopper ; middle Acheulian.

4. THE MICROLITHIC INDUSTRY

A. Relation of the microlithic site to the other sites in the region

A microlithic industry was noticed by the first author about 4 ft. below the Upper Alluvium along the southern bank of Baliā Nadī near Koṭā. It is predominantly a limpid quartz industry, the supply of vein quartz for the tools being amply available in the reefs and dykes in the granitic area at Kathwār (24° 1′ 30″ N.; 82° 44′ E.) nearby in the south.

The presence of microliths in the top layers of the Older Alluvium of the Baliā Nadī shows clearly that after the end of the palaeolithic period in the Singrauli basin, a microlithic culture flourished on the river-banks, as a result of a progressively desiccational change in the environment since the palaeolithic period. The site could have been a factory-site as is suggested by the concentration of microliths and the scatter of waste flakes in close association. This site is perhaps distributionally linked with the microlithic sites discovered by Carlleyle[1] and Gordon[2] in Bāndā, Bundelkhand and Baghelkhanḍ. Still, unlike those sites, the present one has hardly one or two specimens made of chert or chalcedony, the rest being of milky refractory quartz, which is responsible for the poor workmanship of the tools and is, in size, microlithic of necessity.

B. Nature of the industry

In the bulk of the collected material, consisting of both cores and flakes of vein quartz, there are seventyfive specimens which may have been regular artefacts. These microliths comprise a mixed industry, predominantly characterized by parallel sides and blunted-backed blades, thirty in number, with the former comprising crude primary flakes as well as a few good retouched specimens and the latter worked by steep retouch. Further, there is a series of lunates, ten in number, with both the chord as well as the arc blunted and mostly crude, but three good ones show retouch. There are, again, some almond-shaped points, mostly on tiny Clactonean flakes and worked round the margin. This group contains an exquisite specimen of cordiform spear-head of crystal quartz (no. 132, fig. 8), more than 2 in. in length and about 2 in. in width and pressure-flaked all over, which could be easily taken to represent a 'late Acheulian or early Mousterian' cordate coup-de-poing. It is a wonder how this specimen in brittle material withstood the flaking in spite of the serpentinous crack passing across it. In consideration of its extraordinary freshness and the unworkable nature of its material and a number of tiny tools of a similar function of the same material among the microliths, it would fall in the Mesolithic milieu. The technique involved in the microliths indicates a survival of the palaeolithic tradition.

There are a number of cores and flakes, some of which look like sorts of scrapers, including two diminutive pebble scrapers. There are many (accidental) piercers, some of which show signs of use. There is a conspicuous absence of burin in the collection excepting two flakes (nos. 159-160, fig. 8 ; pl. XXV) in which traces of burin-facet are perceivable. Many of the blades have vestiges of the bulb of percussion on their primary flake-surface, and some of them develop into arrow-heads. There are particularly two tools which are worked like arrow-heads and have a crude shoulder and tang (nos. 138-39, fig. 8 ; pl. XXV).

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[1] V. A. Smith, 'Pygmy Flints', *Indian Antiquary*, XXXV (1906), pp. 185-95.

[2] D. H. Gordon, 'The microlithic industries of India', *Man*, Feb. 1938 ; 'The stone industries of the Holocene in India and Pakistan', *Ancient India*, no. 6 (1950), pp. 64-90.

The industry as a whole can be characterized as a non-geometric one denoted by parallel-sided blades, lunates and points of milky quartz. Only a few tools are either finished or re-touched. Even of the lunates, only three are anywhere near perfection. The general nature of the tools reminds us of a degenerate Upper Palaeolithic blade-tradition. The industry, devoid of any associated pottery, can probably be ascribed to an early Mesolithic period.

The following table shows the number of each type in the collection.

Types	*Number*
Backed blades	19
Parallel-sided blades ...	12
Lunates	10
Cores and core-scrapers ...	10
Accidental piercers ...	8
Miscellaneous worked flakes ...	7
Almond-shaped points ...	6
Arrow-heads	2
Flake-blade	1
Total ...	75

C. DESCRIPTION OF THE MICROLITHS (FIG. 8 ; PLS. XXIV-XXV)

(*i*) *Lunates* (*nos.* 91-100)

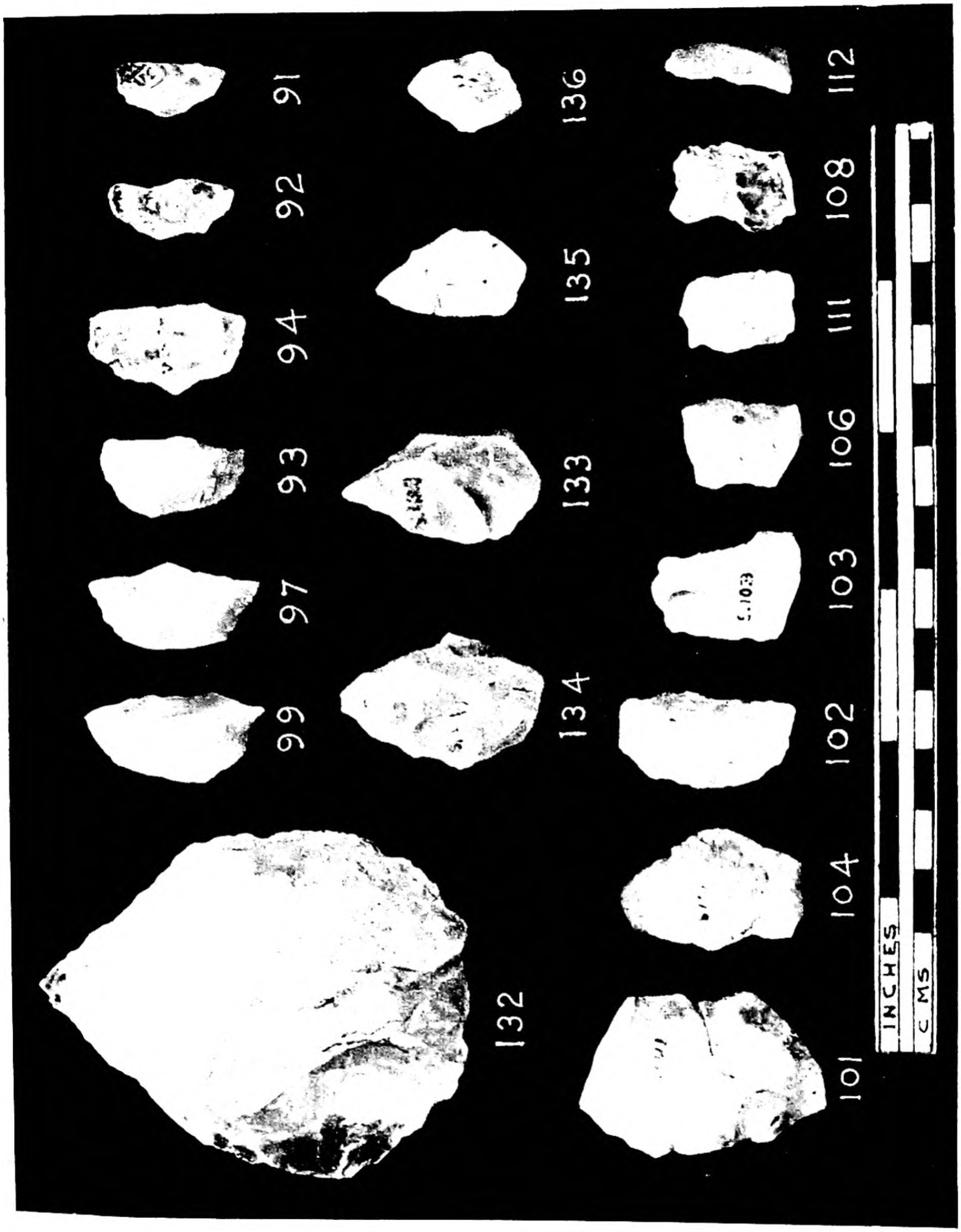
Some are crude but others are fairly neatly-made specimens. Six of them have blunted chords (nos. 93, 94 and 97-100) and the rest are of the usual blunted arc type. In a majority of cases the lunates are so crude that both the edges are not much worked, and the chord in two cases (nos. 95 and 97) makes a double concave curve instead of a straight line. Only four specimens (nos. 91-94) are finished ones, and three of them show signs of use.

(*ii*) *Parallel-sided blades* (*nos.* 101-112)

These have both sides sharp with a low median ridge. The undersides are mostly flat primay flake-surfaces, and many of the tools denote signs of use. Three of the specimens are elongated and have converging sides, which perhaps indicate that they could have developed into arrow-heads as well.

(*iii*) *Various blunted-backed blades* (*nos.* 113-131)

These have a bigger and cruder facies (nos. 113-120), eight exhibiting only primary flakes-scars and generally varying from a triangular to quadrangular cross-section and with the absence of any working. The rest have the working-edge with high retouch, though intentional backing is visible only in about half-a-dozen specimens, and some of these are fragmentary. A majority of the blades shows some part of the edge serrated due to use. There is one pointed blade on a thin concavo-convex flake of greenish chert.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Microliths (see pages 60-62)

PLATE XXV

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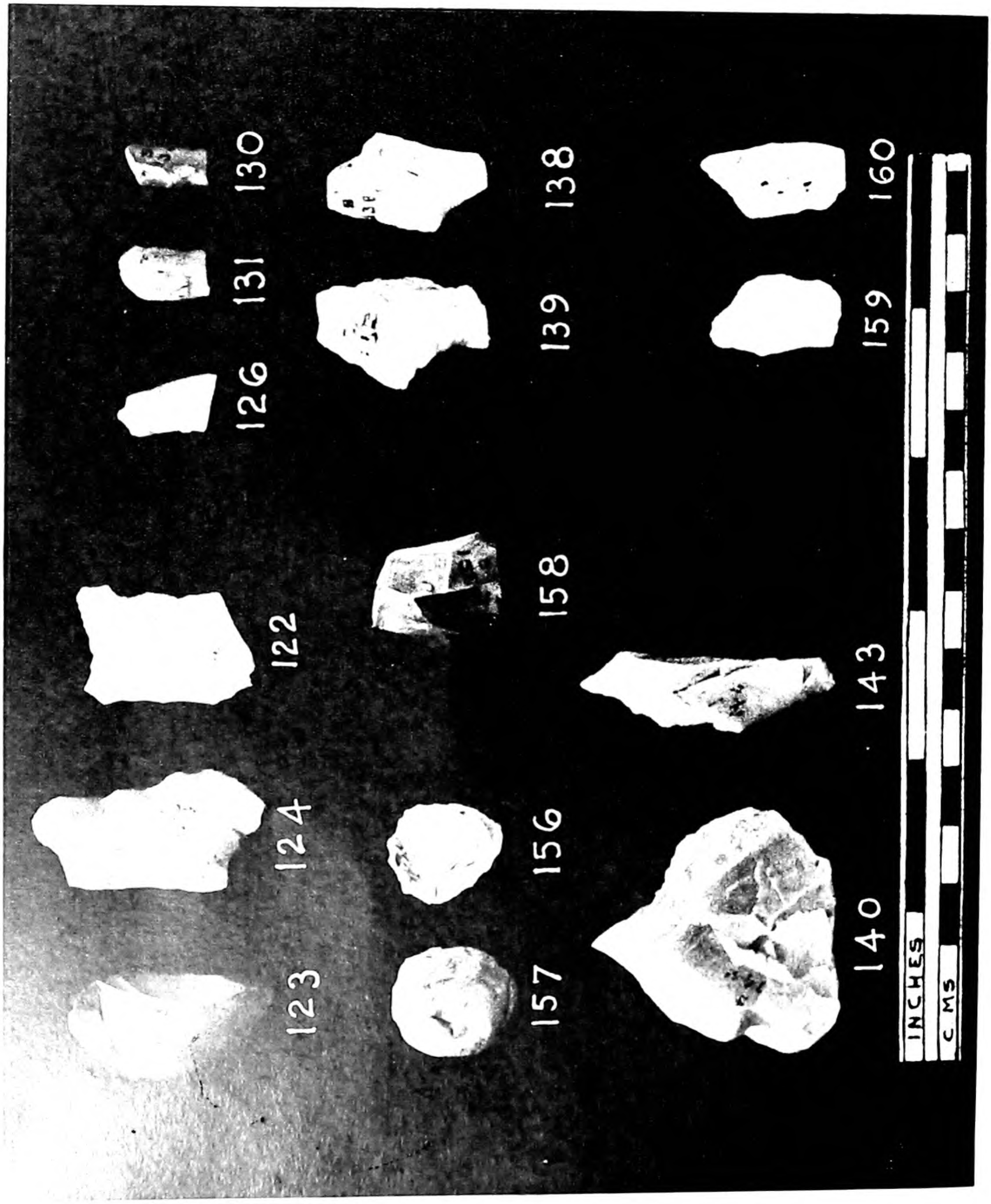
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Microliths (see pages 60-62)

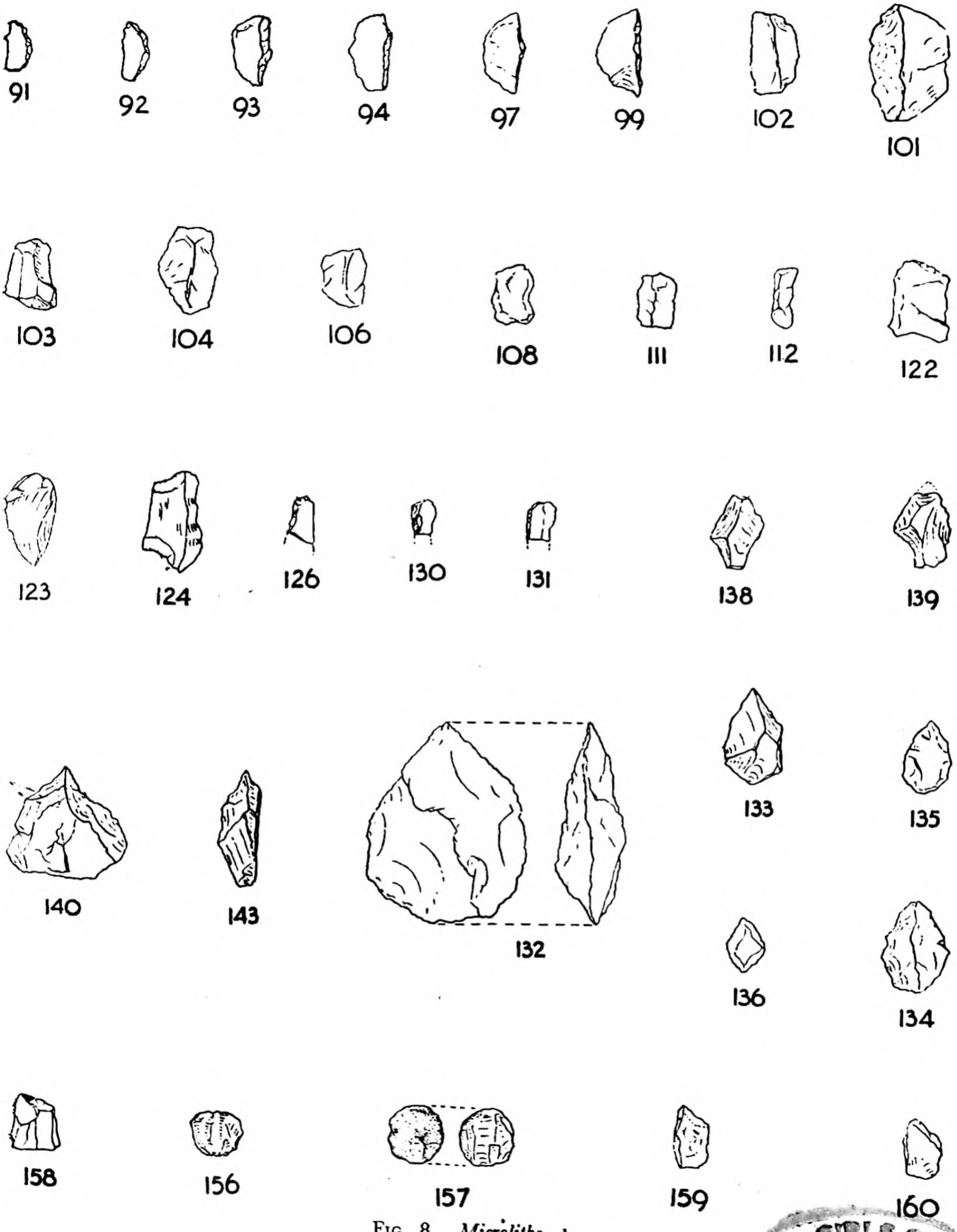
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FIG. 8. *Microliths.* ½

GOVT. GIRLS COLLE
Acc. No.

(*iv*) *Almond-shaped points* (*nos.* 132-137)

Of these there is an extra-big specimen of crystal-quartz ; it is a spear-head and is executed after the immaculate late Acheulian or early 'Mousterian' cordiform type, worked on both faces and with sharp edge all around. Of the remaining five, all of which are almond-shaped and are made on milky quartz, three have a relatively better trimming with their underside showing the primary flake-surface in some cases. They are mostly of the same size. They might have been used as arrow-tips and thus, with the similarity in material and function to the bigger cordiform type, may appropriately be classed together in the mesolithic mileau.

(*v*) *Arrow-heads* (*nos.* 138-139)

There are two specimens of this. One of them (no. 139) shows a left-handed shoulder and the other shouldered on both sides with a rudimentary tang. This tool-type has been noticed by Gordon also.

(*vi*) *Piercers* (*nos.* 140-147)

Most of these are accidental tools though showing in some cases signs of occasional use. They are mostly on thick flakes and cores, roughly triangular in cross-section and might have been used as piercers.

(*vii*) *Cores and core-scrapers* (*nos.* 148-157)

These are ten in number, most of them irregular micro-cores. Of these there are two diminutive core-scrapers, one of them retaining a cortical surface and the other, of crystal-quartz, showing working all over.

(*viii*) *Flake-blade* (*no.* 158)

This is a thick flake of green chert, rather bladish and of triangular cross-section. It exhibits some trimming at one of its cross-wise edges, with an adjacent lengthwise blade-edge.

(*ix*) *Miscellaneous worked flakes* (*nos.* 159-165)

These contain a few thick flakes, mostly oblong, with working and marks of usage along some part of the edges. Among these are two bladish flakes in which rudimentary traces of angle-burin facet seem to feature, though this does not repeat definably in any other specimen to make it a definite type-tool.

CONCLUSION

The expedition to the Singrauli basin was undertaken mainly for a field-investigation of a specific issue raised by De Terra more than a decade back. It resulted in the discovery and location of not only the laterite and the palaeolithic site on the Baliā Nadī not far from Koṭā but also a microlithic site on the bank of the same river. These two industries occur in the Rewā region as well, wherefrom a few palaeolithic tools were found

ATE XXVI

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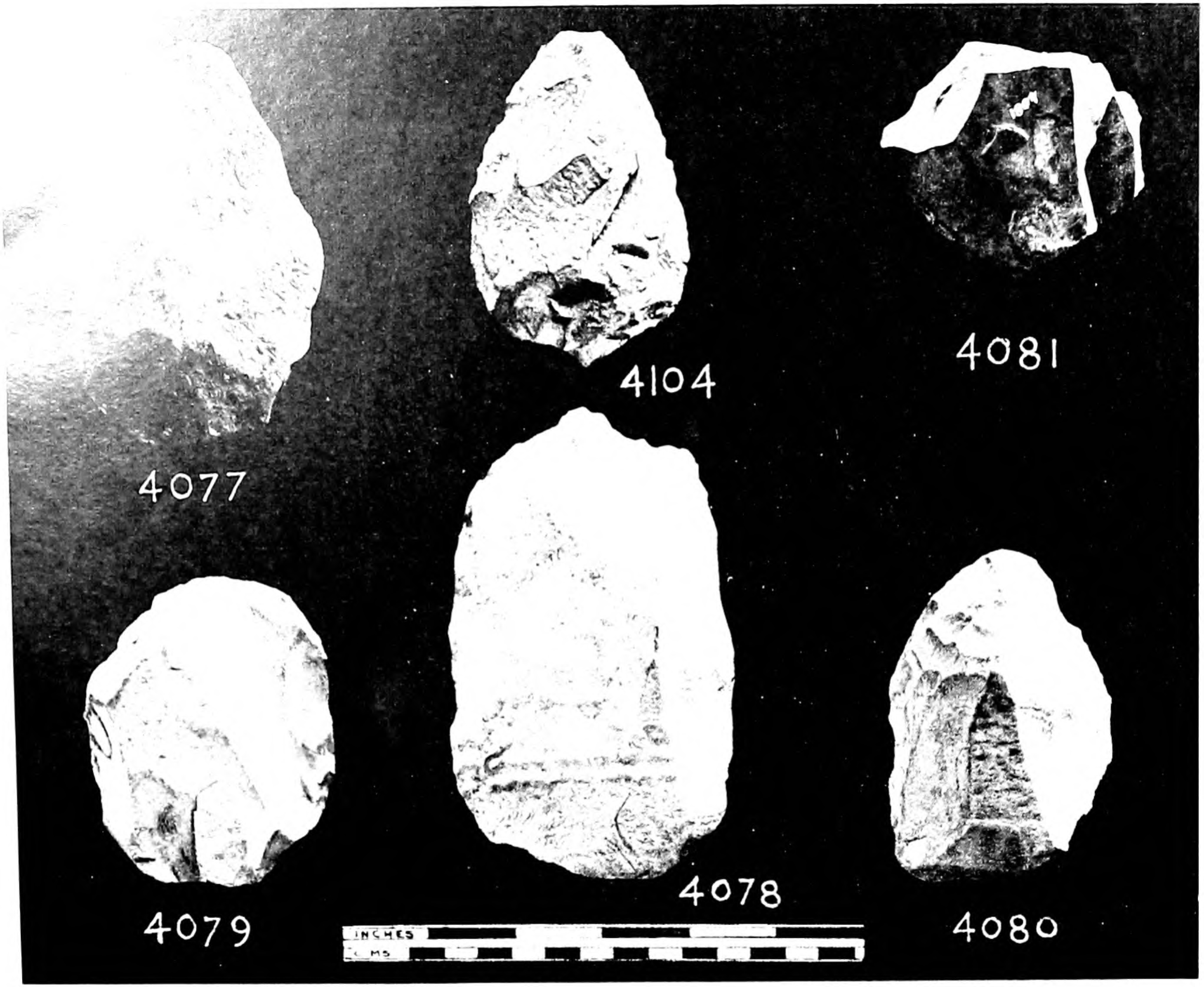
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Palaeoliths from Rewā. Foote's collection (see page 63) in 1897 by Oldham round about the Rewā town in the Tamasā basin (fig. 9 ; pl. XXVI).[1] There is, however, a notable difference between the raw material of the Rewā palaeolithic industry and that of the Singrauli basin, the former being predominantly of ' porcellanite, a kind of hornstone or baked shale which ', according to Foote, ' occurs in the lower Vindhyan rocks '. The extreme antiquity of the Rewā implements is shown by the fact that the unaltered stone is quite dark, and ' the weathering of the older breakage shows in shades of grey of greater paleness according to age '.

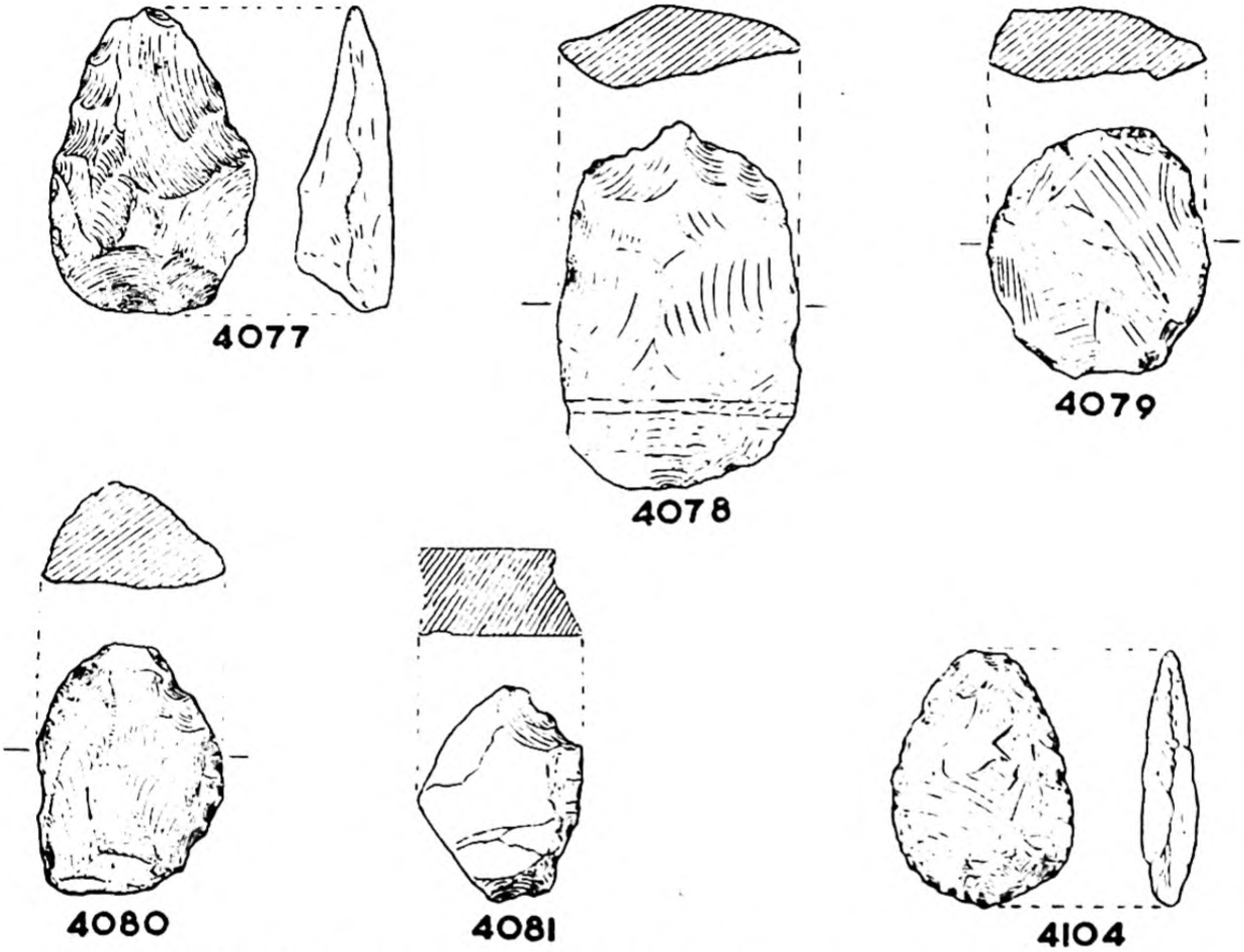

FIG. 9. *Palaeoliths from the Tamasā basin, Rewā, Vindhya Pradesh (Foote's collection, Madras Museum).* 1/3

The material of which the Rewā tools are made is in fact black flint with its laminations appearing even through the heavy patina. A remarkable feature in this context is that the specimen no. 57 of our Singrauli collection betrays the same flinty composition as, for example, the specimen no. 4078 of the Rewā collection and is also patinated in a dirty cream (porcelain-like) colour.[2] This straying of the flinty raw material from the Tamasā basin into the Singrauli basin may represent a close cultural contact that existed between these two areas in the palaeolithic times and emphasizes the need for a systematic regional survey of the palaeolithic industries along the river-valleys as an essential prerequisite for a study of the development and migration of Old Stone Age cultures in this region.

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[1] Nos. 4077 to 4081 and 4104 of Foote's collection, now in the Madras Museum. Foote, *op. cit.*

[2] Also, specimen no. 4081 of the Rewā collection appears to satisfy Movius' ' hand-adze ' type and thus gives an additional significance to the prevalence of the ' chopping-tool-complex ' in the area.

Further, the occurrence of palaeoliths in the Rewā region along with those reported from another place north-west of Rewā, near Raipur on the Yamunā (from where quartzite palaeoliths, akin to the Madras industry, were discovered by C. Maries in 1894 and deposited in the British Museum) would clearly encourage another link-survey of the region lying between the Tamasā basin in Rewā and the Sohan basin in the Panjab. This would help us in fixing chronologically the mutual reactions between the southern Madras biface industry and the Sohan pebble-flake industry in this part of India. A similar survey of the not too vast region lying between the Singrauli basin and the Swarnarekhā and the Śankh basins in Orissa (above, p. 48) is also equally desirable.

In this research the Geological Survey of India has to join hands with prehistoric archaeologist for studying the denudation-chronology of the Singrauli basin, where we got a glimpse of a double cycle of deposition on the Rihand correlatable to a similar depositional cycle in the Bichi Nālā as well. This is all the more urgent as the palaeolithic site on the Baliā Nadī is sure to be drowned once the Rihand dam is completed in a few years' time.

The nature of the geological and physiographic problems connected with this area is indicated in the following observations of Professor Zeuner (made in correspondence) :—

'The section of Locality I[1] suggests an erosional phase which revealed the bed-rock to below the floor of the Baliā Nadī prior to the formation of the mottled clay and the other deposits. The conditions are much the same as in river-valleys of other parts of India. But Localities II and III show a very different picture, namely erosion through bed-rock. The mottled clay is largely absent. Three alternative interpretations may be suggested :

'1. The gradient of the rock-bench on which the deposits lie is flatter than that of the present Baliā Nadī floor. This would be in agreement with a larger water-volume during the gravel phase. It would however be difficult to understand why the rock-bench is lower in Locality III than in Locality II, without the assumption of a course of the Baliā Nadī deviating considerably from the present one.

'2. Since the valley of the Baliā Nadī itself is likely to be a comparatively useful physiographic feature of the area, it is possible that the gravel-bed was laid down by another river, possibly the main river, the Rihand. The difficulty in this alternative is that it would be difficult to understand the unevenness of the bench of this river in the area unless one assumes that the river was in ungraded condition.

'3. The third alternative would be to assume that an ancient land-surface was drowned by deposits, the mottled clay being in the depressions, whilst the gravel formed on the humps of the Talchir conglomerate, possibly directly from re-deposited boulders picked up by the river from this bed-rock. No fossil-weathering horizon, however, was seen supporting this alternative.

'The Bichi Nālā, on the north side of the Rihand on the way from the Rihand crossing to Pipri, has the normal sequence of a large aggradation followed by a series of erosional phases up to the modern level. Unless tectonic movements have made conditions in this area very complex, it appears that alternative 3 is the most likely. It will be necessary to make a topographical survey of the levels and of the slope of the floors in the Baliā Nadī and Bichi Nālā before this area is submerged by the reservoir.'

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[1] This and the following localities have been referred to above, pp. 45-46.

Simultaneously, the question of the age of the laterite has also to be tackled : one has to investigate the climatic changes operating in the formation of laterites on higher altitudes on the one hand and that of the kankar-formation in the implementiferous fluviatile gravels of the river-valley lower down on the other, the latter formation being as highly favourable for the preservation of the Pleistocene fossil-remains as the former is for destroying them. It is interesting to note that in the alluvium on the north bank of the Son, some fossil-bones of Bovidae, and some Lamellibranchs were found and identified as Batissa Petrolia and B. Crawfuvdi.[1] This discovery, far away from Potwar, is likely to re-awaken and stimulate interest in the question of the Plio-Pleistocene boundary in India, over which there has been so much of interesting controversy between De Terra and Pilgrim. Moreover, this, along with the find of fossil-remains identified with *Bos Gaurus* by Cockburn (above, p. 43), would warrant an intense palaeontological study of this region.

The crude microlithic quartz industry of the Baliā Nadī equally stands in marked contrast to the essentially chert and chalcedony pygmy industries of Bāndā, Bundelkhanḍ, Baghelkhanḍ, Rewā, Mirzāpur and the rock-shelters of the Kaimūr range. Our microlithic site is an open-air site occurring appreciably deep (nearly 4 ft.) in the Upper Alluvium and is unassociated with pottery. This will doubtless argue for a great antiquity for the microlithic industry in this area, probably taking it back into the Mesolithic. At any rate, the question of the age of the open-air microlithic sites as well as rock-shelter sites with paintings will have to be reviewed *de novo*.

---

[1] **Information supplied by the Geological Survey of India.**

RĀJGIR 1950

By A. Ghosh

In this article the Deputy Director General for Exploration describes the results of a small excavation at Rājgir, one of the outstanding pre-Christian capitals of India. Apart from the pottery-types, the discovery of a hitherto unknown type of post-cremation burial revealed in the operation is noteworthy.

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1. INTRODUCTION

GIRIVRAJA or Rājagṛiha,[1] the capital of ancient Magadha (south Bihar), is at present represented by the vast ruins inside and outside an extensive valley (25° 2′ N.; 85° 26′ E.) situated about 60 miles to the south-east of Patna, the present capital of Bihar. The valley is surrounded on all sides by hills which form the northern extremity of the Barābar range and bear traditional names, differently enumerated in different ancient texts. They provide an excellent natural fortification for the valley they surround (fig. 1), and this must have been the major factor responsible for its selection as the capital-site of Magadha.

At a very early stage in the life of the city the natural defences were substantially re-inforced by a fortification consisting of a high rubble-wall running at the top of all the hills, with a circuit of about 25 miles, and the natural gaps between the hills were utilized as gates in the fortification. Inside the valley were other defensive walls built in different periods, the chief of which was the inner defensive wall (pl. XXVII), generally built of heaped-up earth with a rough rubble-core and enclosing a pentagonal area with a perimeter of 5 miles.[2]

---

[1] The other and less popular names of the city were Vasumatī, Bārhadrathapura ('the city of Brihadratha', an early legendary king) and Kuśāgrapura. Girivraja means 'the enclosure of hills', and is a most appropriate name for the hill-girt valley; Rājagṛiha means 'the abode of the kings', i.e. the capital, the present name, Rājgir, being derived from it.

[2] For a brief history and general description of the ruins, see M. H. Kuraishi and A. Ghosh, *A Guide to Rājgir*, 3rd ed. (Delhi, 1951).

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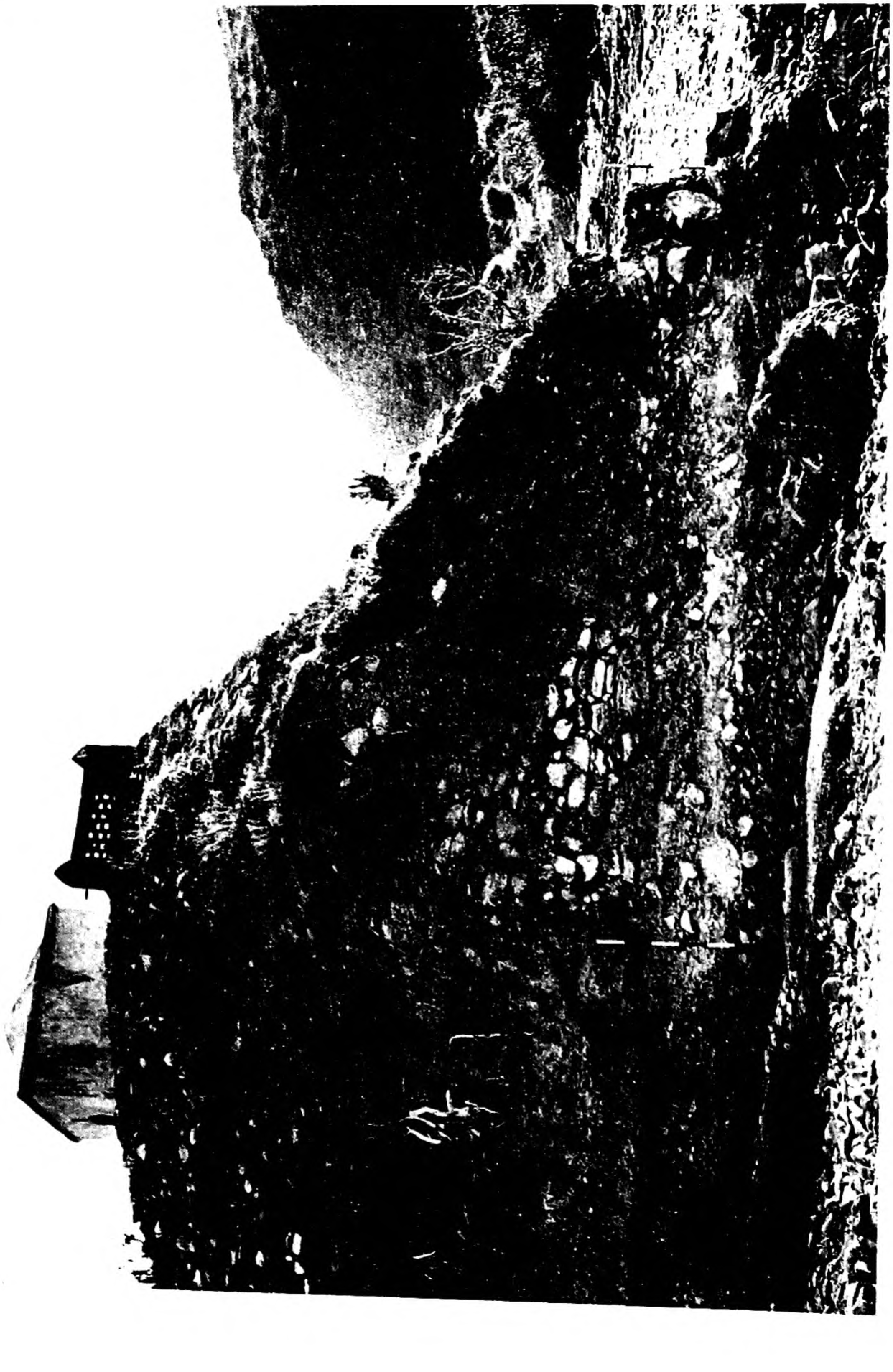
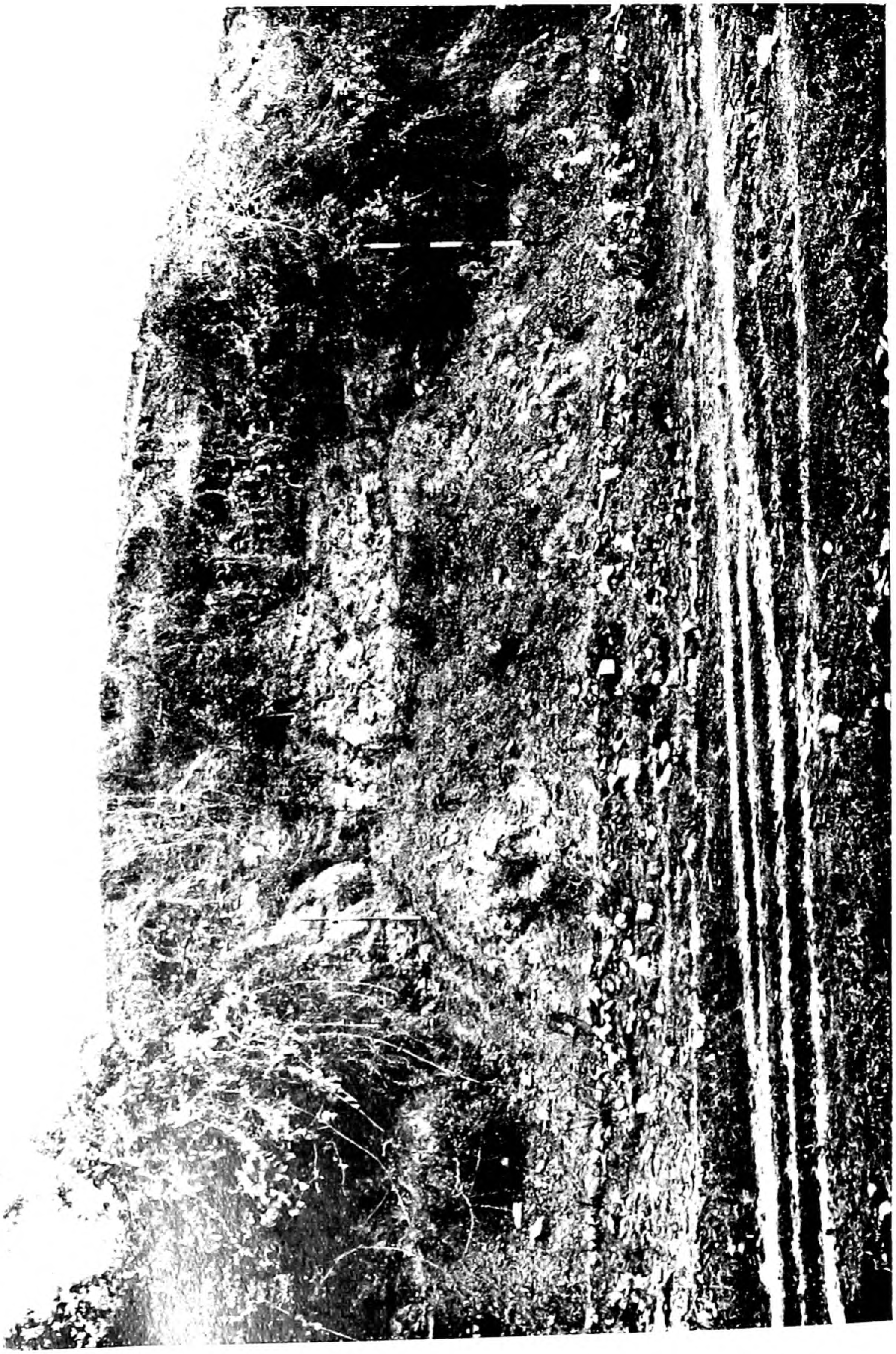
PLATE XXVII



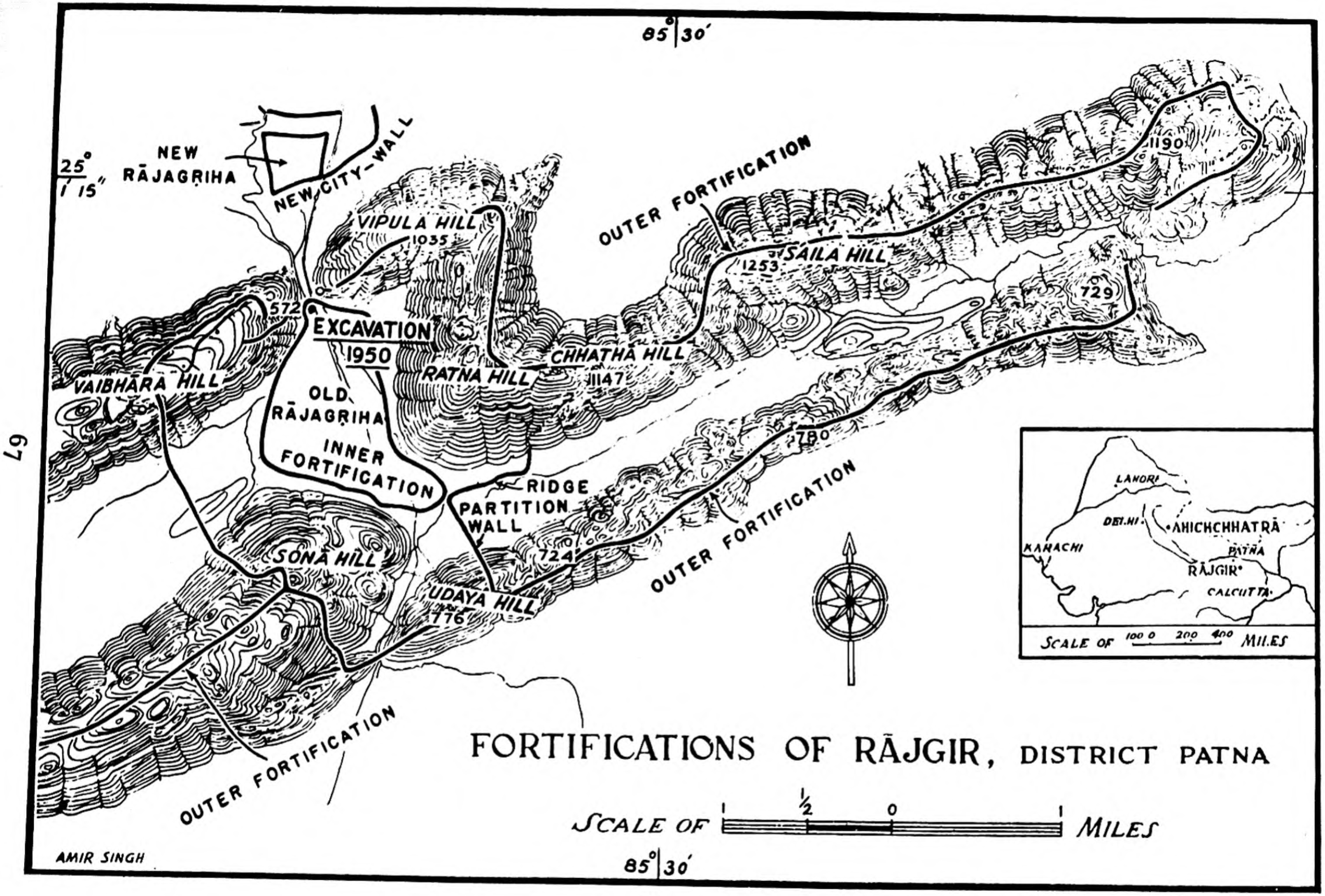
Rājgir: general view of inner fortification near the north gate with a modern temple at the top

PLATE XXVIII

To face page 67



General view of the river-cutting, before excavation


85° 30′
25° 1′ 15″
NEW RĀJAGṚIHA
NEW CITY-WALL
OUTER FORTIFICATION
VIPULA HILL
1035
EXCAVATION 1950
572
VAIBHĀRA HILL
OLD RĀJAGṚIHA
INNER FORTIFICATION
RATNA HILL
CHHATHA HILL
1147
1253
SAILA HILL
1190
729
780
RIDGE
PARTITION WALL
724
SONA HILL
UDAYA HILL
776
OUTER FORTIFICATION
OUTER FORTIFICATION
LAHORE
DELHI
AHICHCHHATRĀ
KARACHI
PATNA
RĀJGIR
CALCUTTA
SCALE OF 100 0 200 400 MILES
SCALE OF 1 ½ 0 1 MILES
AMIR SINGH
85° 30′

FORTIFICATIONS OF RĀJGIR, DISTRICT PATNA

FIG. 1

The traditional history of the place can be traced from the times of the *Mahābhārata* down to a few centuries before Christ.[1] It will suffice to say here that according to Buddhist literature the Magadhan kings ruling from Rājgir at the time of Buddha (sixth-fifth centuries B.C.) were Bimbisāra and Ajātaśatru, with whom Buddha had frequent contacts and the latter of whom is credited with having built himself a new fort outside the valley, its remains, with a circuit of 3 miles, being visible outside its northern gate.

The tremendous archaeological potentiality of Rājgir, one of the key-sites of ancient India, has all along been realized, and many have been the previous explorations at the site.[2] Most of them have, however, been mainly or exclusively concerned with the identification of the ruins with sites associated, in Buddhist literature and the accounts of the Chinese pilgrims,[3] with the life of Buddha. Even when the objective has been more limitedly archaeological, no systematic recording of the stratification and pottery-types is available,[4] with the result that Rājgir has remained practically unlinked with the present-day developments in Indian archaeology. It has, however, figured prominently in the list of sites yielding the Northern Black Polished (N.B.P.) ware,[5] which is practically the sole available factor connecting it with the other pre-Christian sites in northern India and only emphasizes the necessity of a large-scale excavation of the site on sound and systematic lines.

During my visit to Rājgir in February 1950 I noticed that a peripheral part of the anciently-occupied valley along the northern part of the western wall of the inner defences (above, p. 66) had been cut away by the adjacent rivulet known as the Sarasvatī, which separated the valley from the Vaibhāra, the hill enclosing it on its north-west, and the 20 ft. high section thus revealed (pl. XXVIII) showed, at its lower depth, a large number of N.B.P. sherds. As next to nothing was known about the stratigraphic position of the N.B.P. ware at Rājgir, I decided to scrape a part of the cutting with a view to obtaining a fresh section in which the strata yielding the ware could be properly located. For this purpose it was necessary to take back the cutting by about 3 ft. from the irregular edge left by the river along a length of 9½ ft. (pl. XXX). As I was unprepared, any excavation on a large scale was out of the question. The incidental results, which are published here, should not be taken as an index of what should be expected all over the vast site, but will,

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[1] The literary references to Rājgir may be seen in B. C. Law, 'Rājagṛiha in ancient literature', *Mem. Arch. Surv. Ind.*, no. 58 (Delhi, 1938).

[2] For the description of the ruins and their probable identifications with ancient sites and of early explorations, see A. Cunningham, *Arch. Surv. Ind. Rep.*, I, III, and VIII (Calcutta-Simla, 1871-78); Cunningham, *Ancient Geography of India*, ed. S. N. Majumdar Śāstrī (Calcutta, 1924), pp. 535-36; A. Stein, 'Notes on an archaeological tour in south Bihar', *Indian Antiquary*, XXX (1901), pp. 54-63 and 81-97; Th. Bloch, 'Excavations at Rājgir', *An. Rep. Arch. Surv. Ind., Eastern Circle*, 1905-06 (Calcutta, 1907), pp. 13-15; J. Marshall, 'Rājagṛiha and its remains', *An. Rep. Arch. Surv. Ind.*, 1905-06 (Calcutta, 1909), pp. 86-106; V. H. Jāckson, 'Notes on Old Rājagṛiha', *ibid.*, 1913-14 (Calcutta, 1917), pp. 265-71; R.P. Chanda, 'Jaina antiquities at Rājgir', *ibid.*, 1925-26 (Calcutta, 1928), pp. 121-27; G. C. Chandra, 'Excavations at Rājgir', *ibid.*, 1934-35 (Delhi, 1938), pp. 52-54; D. N. Sen, 'Sites in Rājgir associated with Buddhā and his disciples', *Journ. Bihar and Orissa Res. Soc.*, IV (1918), pp. 113-35; Sen, *Rājgir and its Neighbourhood* (Patna, 1924); R. C. Majumdar, 'Identification of some old sites in Rājagṛiha', *Journ. Asiatic Soc. Bengal* (Letters), XV (1949), pp. 65-80.

[3] S. Beal, *Buddhist Records of the Western World* (London, 1884), I, p. lviii, and II, pp. 149-66; T. Watters, *On Yuan Chwang* (London, 1904), II, pp. 148-62.

[4] For example, I have failed to find in any published report whether the natural soil was struck by excavation.

[5] Krishna Deva and R. E. M. Wheeler in *Ancient India*, no. 1 (1946), pp. 55-58.

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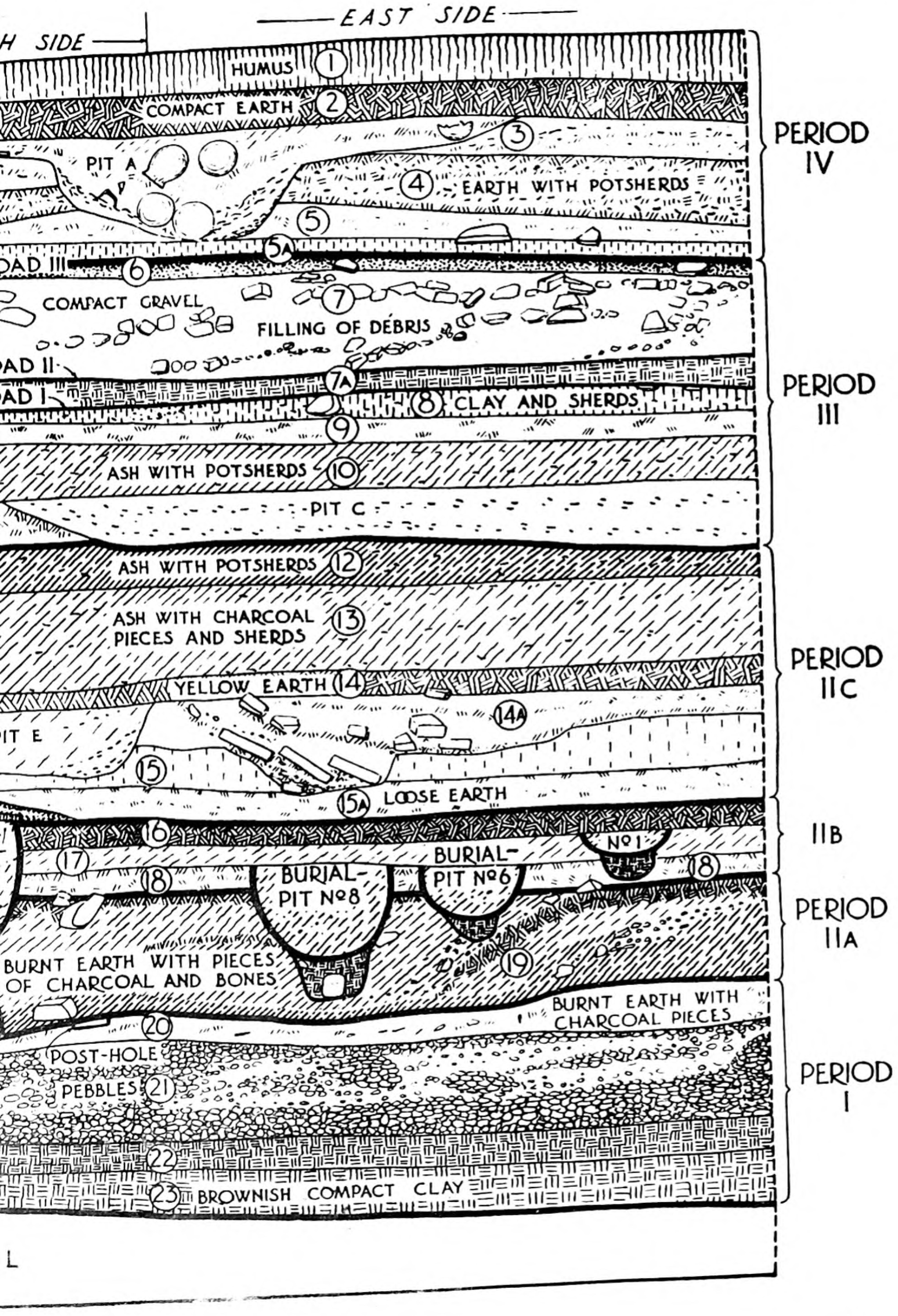
H SIDE
EAST SIDE
HUMUS ①
COMPACT EARTH ②
③
PIT A
④ EARTH WITH POTSHERDS
⑤
5A
AD III ⑥
COMPACT GRAVEL
⑦
FILLING OF DÉBRIS
AD II
AD I
7A
⑧ CLAY AND SHERDS
⑨
ASH WITH POTSHERDS ⑩
PIT C
ASH WITH POTSHERDS ⑫
ASH WITH CHARCOAL PIECES AND SHERDS ⑬
YELLOW EARTH ⑭
14A
IT E
⑮
15A LOOSE EARTH
⑯
⑰
⑱
BURIAL-PIT Nº 8
BURIAL-PIT Nº 6
Nº 1
⑱
⑲
BURNT EARTH WITH PIECES OF CHARCOAL AND BONES
⑳
BURNT EARTH WITH CHARCOAL PIECES
POST-HOLE
PEBBLES ㉑
㉒
㉓ BROWNISH COMPACT CLAY
L
PERIOD IV
PERIOD III
PERIOD IIC
IIB
PERIOD IIA
PERIOD I

I fancy, give an elementary idea of the chronological length of the occupation of the city, with reservations for a wide variation on either side.

In this work I had the collaboration of my colleague Mr. Krishna Deva, Superintendent, Department of Archaeology, Central Circle, Patna, who had accompanied me to Rājgir. The section of the excavation was drawn by Mr. Raghbir Singh, Senior Draftsman of the Department. The photographs of the site were taken by Mr. N. N. Bose, Photographer of the Central Circle, and that of the small finds by Mr. S. G. Tiwari, Photographer-Instructor of the Department. For the classification of the pottery I am grateful to Mr. B. M. Dhruva, attached to the Department as a scholar of the Saurashtra Government.

2. STRATIFICATION (PL. XXIX)

In spite of the limited scope of the work, the stratification, as revealed, was interesting. Above the natural conglomerate were two layers (23 and 22) of brownish compact clay, evidently riverine deposits, with occasional shapeless sherds, which were overlain by a thick bed of pebbles (21), no doubt also deposited by the river in one of its floods during a very

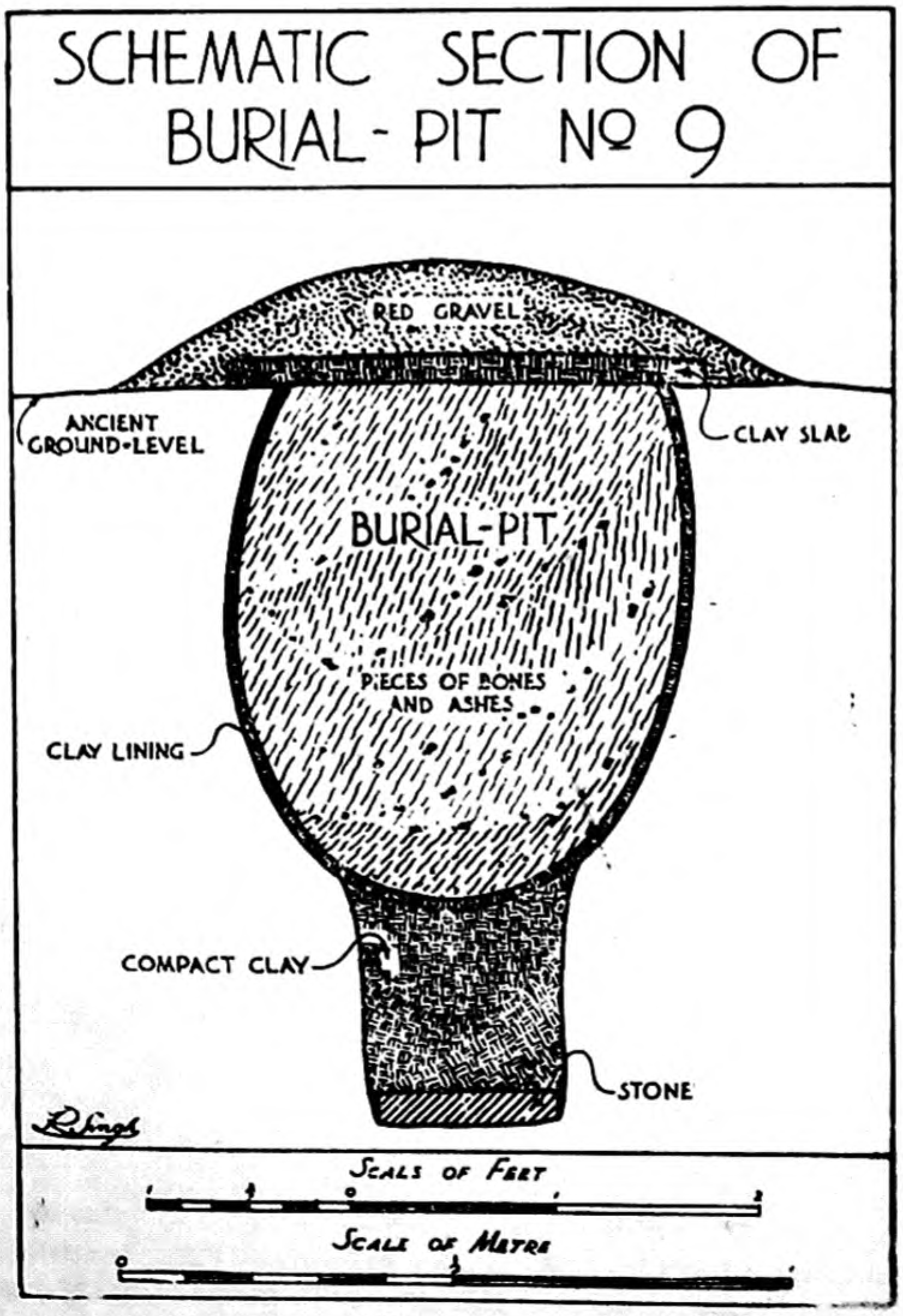
SCHEMATIC SECTION OF BURIAL-PIT No 9
RED GRAVEL
ANCIENT GROUND-LEVEL
CLAY SLAB
BURIAL-PIT
PIECES OF BONES AND ASHES
CLAY LINING
COMPACT CLAY
STONE
SCALES OF FEET
1
½
0
1
2
SCALE OF METRE
0
½
1

FIG. 2

early phase of the occupation of the site, and containing rare sherds 'rolled' by water-action. The deposit was capped by a layer (20) of burnt earth with charcoal pieces.

Real occupation at the spot began with layer 19, which, significantly enough, synchronized with the appearance of the N.B.P. ware. The earlier phase of this period revealed a previously unknown type of post-cremation burials, of which ten (five being seen in the section, pl. XXIX) were traced and showed the following characteristics (pls. XXXI-XXXII).

For the purpose of interring a few bits of charred bones mixed with ashes left after the cremation of the dead, evidently on the bank of the adjacent river,[1] pits with elliptical bottoms and with short funnels still below were dug into the soil. The funnels were filled with clay (in two cases, burial-pits 8 and 9, stone-blocks were also placed), and the sides of the pits were lined with coatings of clay. The 'jars' thus improvised were then filled with bone-bits and ashes collected from the cremations. Only in one case (burial-pit 9, fig. 2) was a thin slab of clay used for sealing the pit, the slab again being covered by a thin deposit of red gravel. Another pit (10) was found to have been left unlined with clay, though it contained material similar to the lined ones.

The upper layers (up to 12) of the period producing the N.B.P. ware do not call for any special remark.

The next period (layers 11 to 6), marked by the disappearance of the N.B.P. and associated wares, showed two road-surfaces concreted with hard clay with sherds (layers 8 and 7A) and a thick filling of brick-bats and sherds (layer 7) capped by compact gravel (layer 6), to provide for a third road-surface.

The last period (layers 5A to 1) did not yield any noteworthy features.

3. CHRONOLOGY

As has been said above, there was hardly any occupation at the spot before the advent of the N.B.P. ware, though it is evident that nearby there had been earlier occupations, sherds wherefrom were washed and got deposited in the pebble and pre-pebble strata. There is no means of ascertaining the date of these occupations, as the sherds are too fragmentary to be affiliated to any known industry.

The origin of the N.B.P. ware has been tentatively ascribed to the fifth century B.C.[2] It is unlikely that future research will bring this dating forward : on the contrary, the possibility lies in the other direction, just as recent explorations have resulted in the expansion of its geographical horizon.[3]

Even assuming, on the basis of the prevalent dating, that the N.B.P. ware first came into being in the fifth century B.C. occupation in Rājgir must have begun earlier, as is indicated by the presence of pottery in the layers earlier than those producing the ware.

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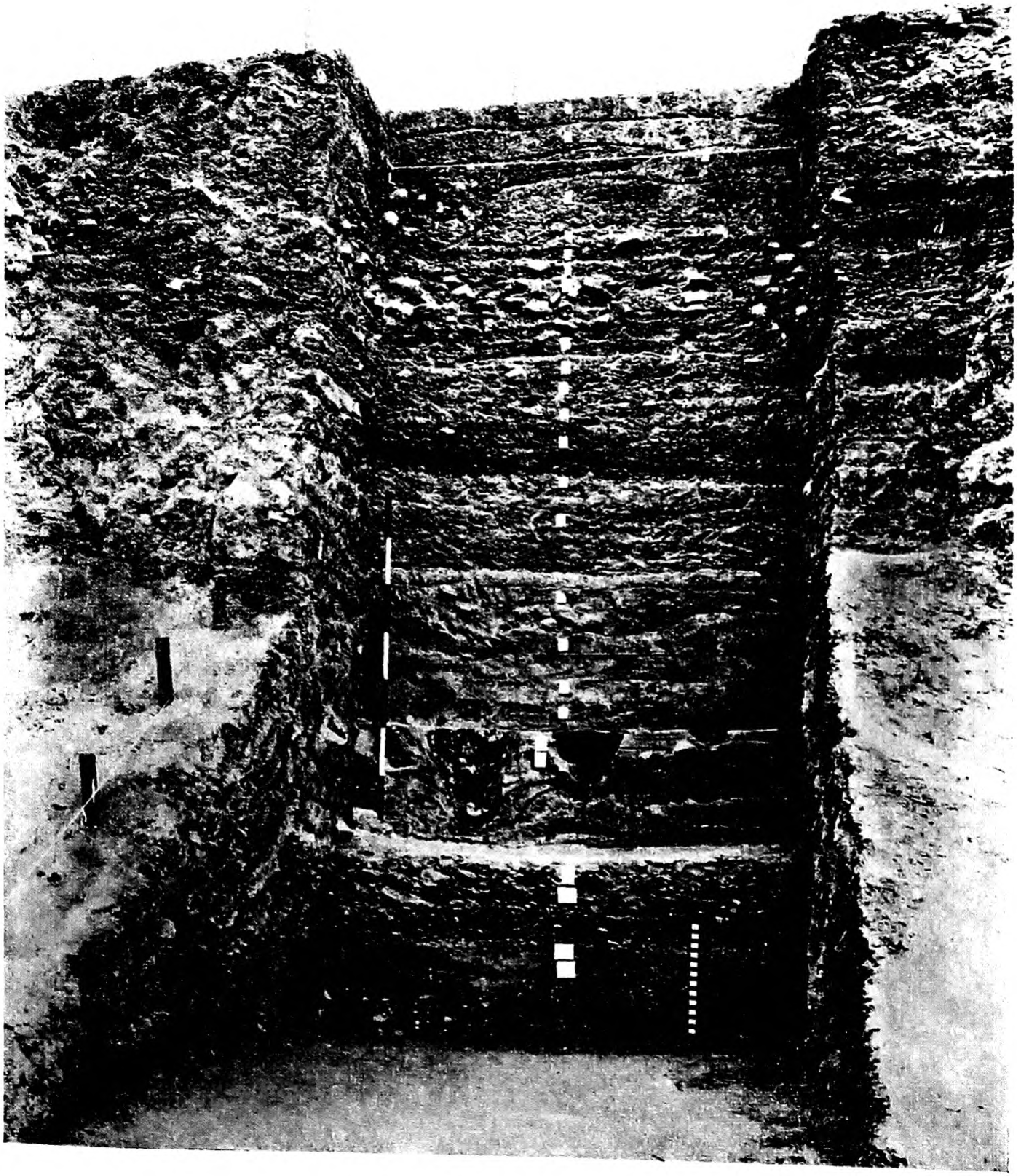
[1] It is interesting to note that this part of the river-bank is still the cremation-ground of Rājgir.

[2] See above, p. 68, footnote 5.

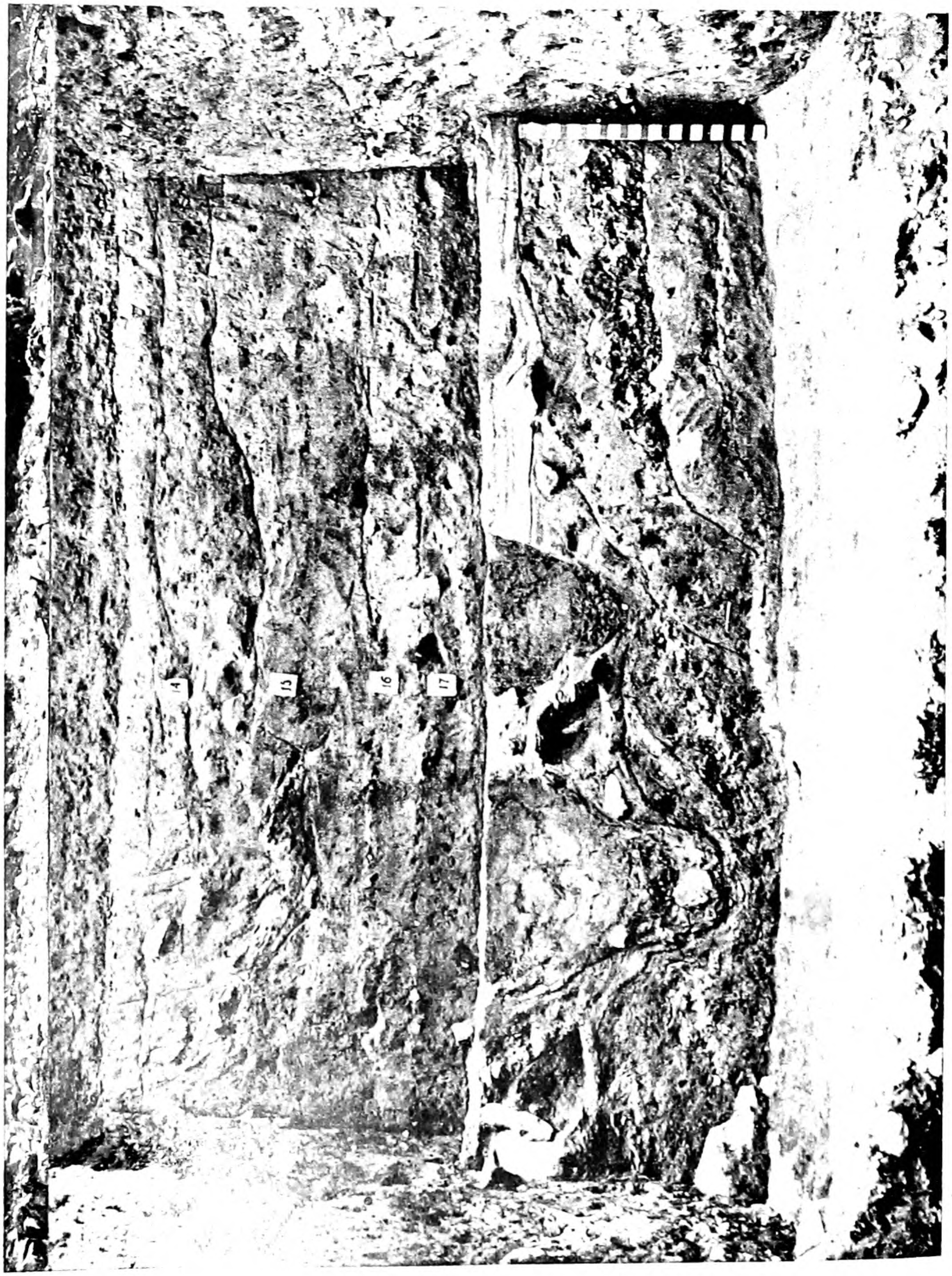
[3] The very nomenclature of the ware suggests its having been restricted to northern India, but it has recently been found as far south-west as Nāsik (20° N.; 73° 47′ E.) and as far south-east as Śisupālgarh near Bhuvaneswar, Orissa (20° 15′ N.; 85° 50′ E.) [*Ancient India*, no. 5 (1949), p. 79]. This emphasizes the necessity of reviewing the geographical distribution of the ware. The current excavation at Kauśāmbī near Allahabad and the proposed excavation at Hastināpura are likely to yield more accurate data for fixing the chronological limits of the pottery than have been hitherto available.



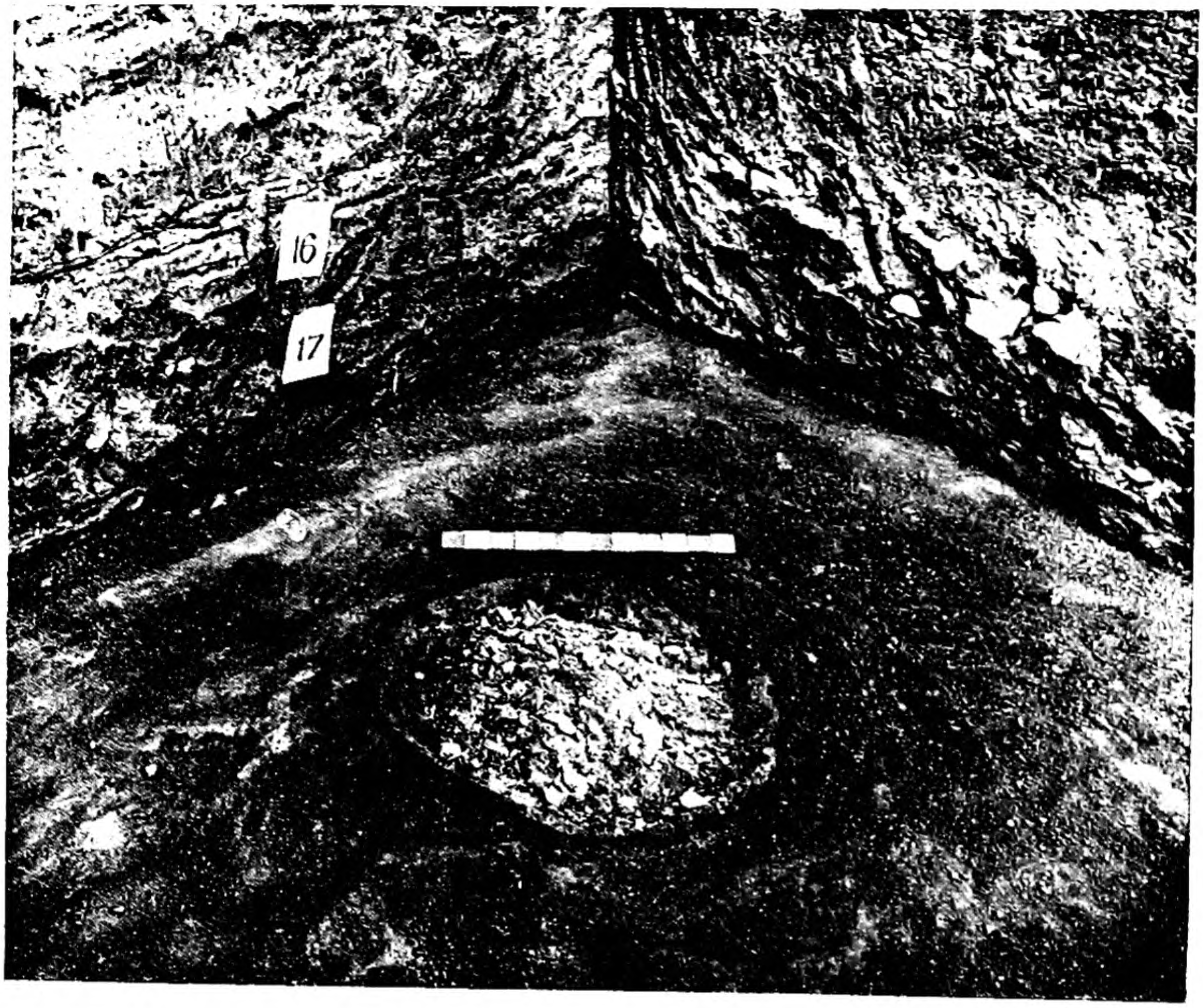
The trench

PLATE XXXI

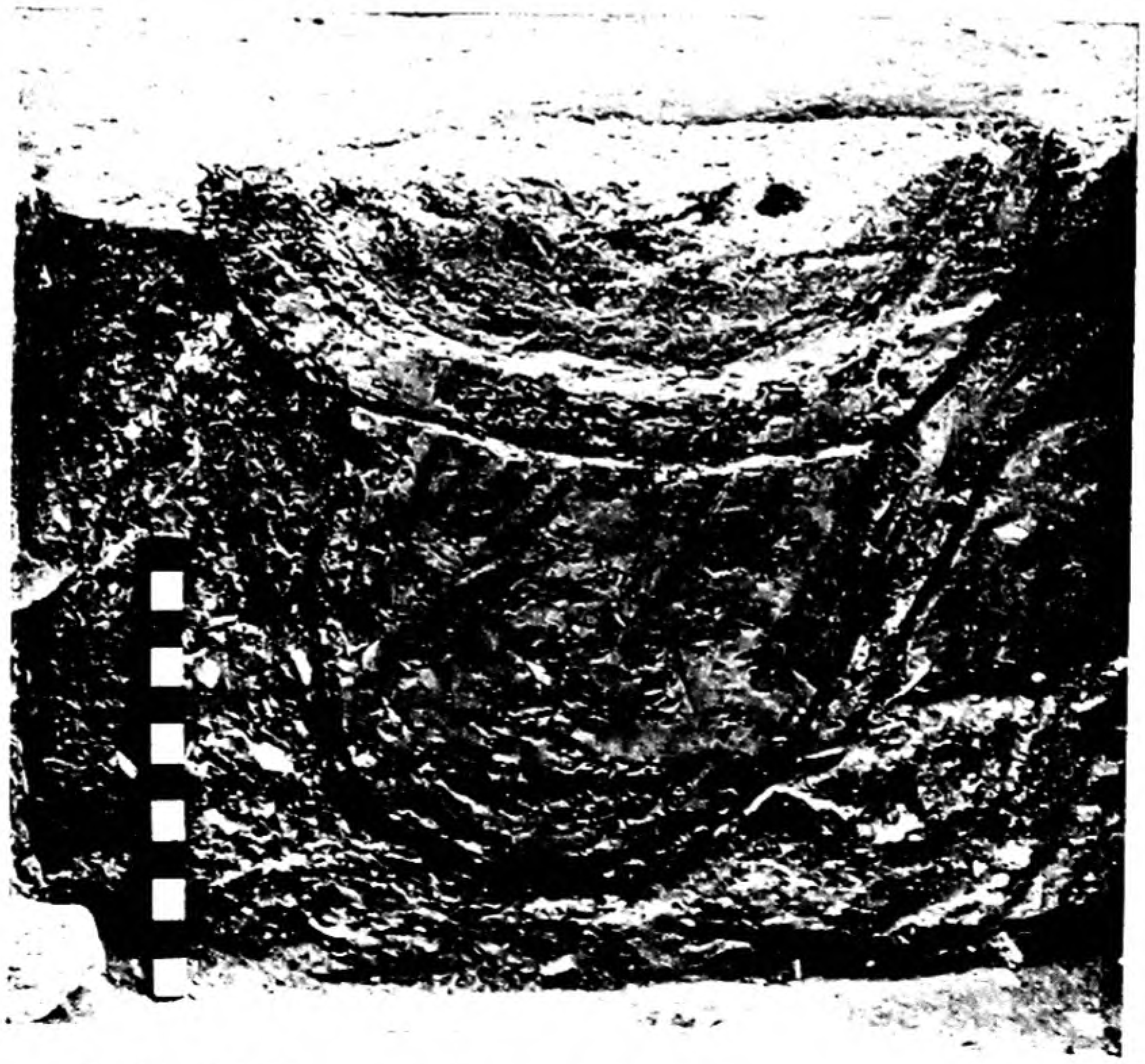
To face plate XXXII



View of the burial-pits (see page 70)

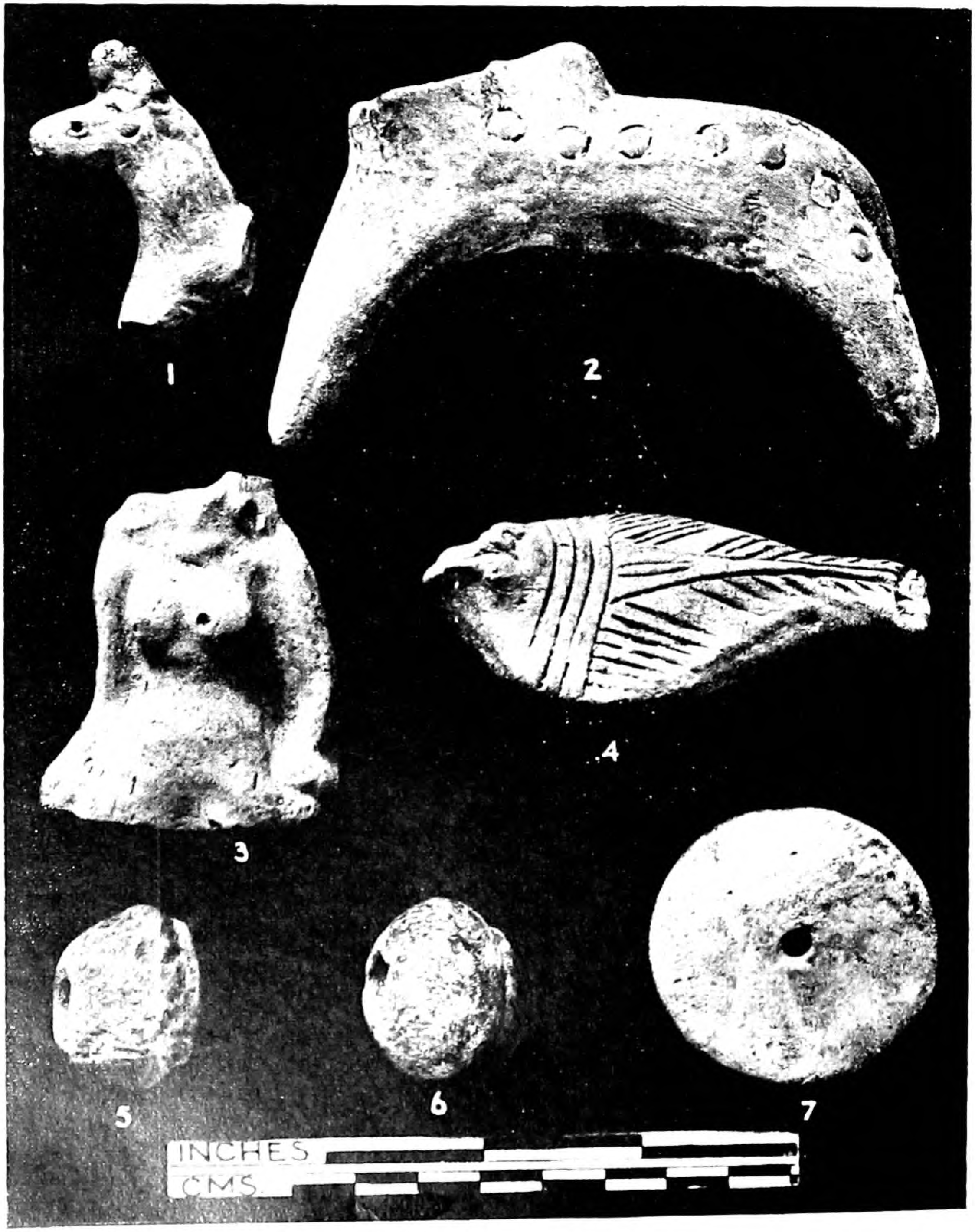


A



B

A, *burial-pit no.* 4; B, *section thereof* (*see page* 70)


1
2
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4
5
6
7
INCHES
CMS.

Small finds (see page 78)

There is no evidence that the N.B.P. ware persisted anywhere in India after the second century B.C. The top-layers yielding this ware may therefore belong to that century, and the next period, in which the ware is absent, should be regarded as dating from the first century B.C. Reliable material at present available for the comparative study of the pottery-types of this latter period is limited, being virtually confined to Ahichchhatrā,[1] though a mass of new material will soon be available by the excavation at Kauśāmbī near Allahabad by the University of Allahabad and the contemplated Departmental excavation at Hastināpura, District Meerut, U.P. The date proposed is, however, confirmed by the similarity of pottery-type 28 (fig. 5, p. 76) to the Ahichchhatrā type 23,[2] where it is found in Stratum VI, dated to 100 B.C.

The next period may be ascribed to the first one or two centuries A.D., which follows not only from the dating of the preceding period but from the resemblance of pottery-type 30 (fig. 5, p. 76) with Ahichchhatrā type 29, of Stratum IV (A.D. 100 and later).[3] But for its slightly-pointed base, pottery-type 17 (fig. 5) is also similar to type 37 of Ahichchhatrā,[4] where it has been regarded as the 'hall-mark of Stratum IV.'

The proposed chronology of the periods is therefore as follows :

Period I : earlier than the fifth century B.C.
Period II : fifth century B.C. (or earlier) to second century B.C.
Period III : first century B.C.
Period IV : first century A.D.

4. THE POTTERY

The pottery found in the excavation is wheel-made and is almost totally unpainted (see, however, p. 77 below). The period of the currency of the N.B.P. ware (Period II) marks a definite phase in the ceramic industry of the site, for along with this pottery emerges a large amount of associated pottery, thus indicating the advent of a new culture.

A. PERIOD I

The pottery of this period consists only of a few sherds which do not give any idea of the prevalent shapes. They are of a crude and coarse red ware with a dull wash of terracotta colour, though a black slip on the outer face is not rare. One sherd has a chocolate slip on the burnished underside and a black slip on the exterior.

B. PERIOD II

Period II is characterized by the presence of the N.B.P. ware, with which is associated black and black-and-red pottery, usually dishes and bowls of the same shapes as are common in the N.B.P. ware itself. The persistent co-existence of the N.B.P. and black wares in the same shapes is a notable feature and indicates their common origin and purpose, the only difference being that the black ware was not treated with the coating that was responsible for the gloss in the N.B.P. ware. At the same time, there are a few specimens of similar shapes in grey ware, which, however, is different in fabric from the Painted Grey Ware found in the lowest levels of Ahichchhatrā[1] and recently discovered on many other sites in northern India[2] and represents a decadent phase thereof.

---

[1] A. Ghosh and K. C. Panigrahi, 'The pottery of Ahichchhatra', *Ancient India*, no. 1 (1946), pp. 37-59.

[2] *Ibid.*, fig. 2, p. 44.

[3] *Ibid.*

[4] *Ibid*

The N.B.P. ware itself is found here in the same colours as have already been noticed, but some sherds have a dull to bright yellowish hue.

The period can be divided into three phases, A, B, and C, on the basis of the quality and quantity of the N.B.P. and associated black and black-and-red wares. Phase A (layer 19) is marked by the complete absence of red ware and contains only N.B.P. and black wares of thin to medium section. Though no definite shapes can be made out in either ware, the indications are that they were only dishes and bowls.

In Phase B (layers 18 to 16), the N.B.P. specimens are generally not too thin, and, towards the end of this phase, show a tendency of becoming thicker. There are occasional pieces of dishes black inside and red outside, as if produced by inverted firing. In the upper strata constituting the phase the black ware tends to lose its polish, a few sherds assuming a dark-grey colour, and red pottery of the same types as are found in the N.B.P. and black wares makes its appearance.

Phase C (layer 15 to 12) is characterized by a gradual degeneration and the ultimate disappearance of the N.B.P. ware. There is a simultaneous deterioration in the quality of black ware, which, towards the end of the phase, becomes dull in colour and is devoid of any polish. Layers 13 and 12 have a preponderant element of thick jars and troughs in dull-red colour.

C. PERIOD III

Except a very few intrusive sherds of the N.B.P., black and grey wares, Period III (layers 11 to 6) represents an exclusively red-ware industry, but no break in culture is indicated, as a few types of the preceding period persist. There is a large percentage of very thick jars and troughs of a coarse sandy fabric.

D. PERIOD IV

This period, consisting of layers 5A to 1, is linked with the previous one by the presence, in its lower levels, of thick jars, which, however, grow thinner in the upper ones, and of bowls of a bright terracotta colour which form a notable feature of this period.

E. THE POTTERY-TYPES

(i) *Types in N.B.P. ware, i-iii* (*fig.* 3)

The types represented in the N.B.P. ware are extremely limited and consist only of dishes and bowls with limited rim-forms.

Type i is a dish with a sharpened incurved rim and a presumably flat base. It is common in Period II, the illustrated specimen, of lustrous yellow hue, being from layer 18. *Type i-a* is similar to type *i*, but is of a larger size and has a convex base. This type also is common in Period II, though the illustrated specimen comes from Period III, where its find is adventitious.

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[1] *Ancient India*, no. 1 (1946), pp. 58-59.

[2] B. B. Lal, 'The Painted Grey Ware of the upper Gangetic Basin', *Journ. Roy. Asiatic Soc. Bengal, Letters*, N.S. XVI (1950), pp. 89 ff.

Type ii is a bowl with a sharpened vertical rim and a sagger base, of fine to medium fabric, being common in the N.B.P. ware strata. The illustrated specimen is from layer 18.

Type iii is a dish with a blunted vertical rim and a flat base, of fine to medium fabric, and is also common in Period II, the illustrated specimen being from layer 16.

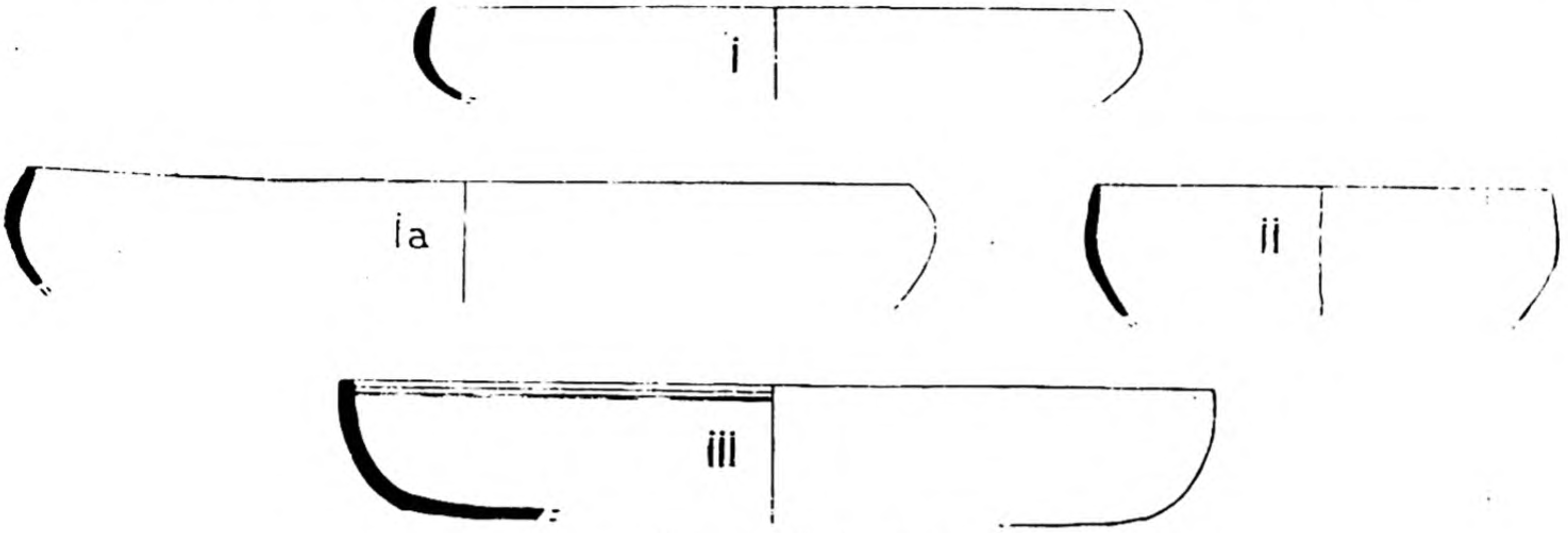

FIG. 3. *Types in N. B. P. ware.* ⅓

(*ii*) *Other types*, 1-34 (*figs.* 4 *and* 5)

Type 1 represents the rim and neck of a large-sized jar. The beaded rim is perched obliquely on a sharply carinated inner neck. Coarse fabric with dull-red slip. A rare type from Period II.

Type 2 is the upper portion of a medium-sized jar with a featureless splayed-out rim on a carinated inner neck. Coarse to medium fabric with dull-red slip. Common in Period II.

Type 3 is the upper portion of a large jar with a splayed-out pointed rim on a sharply carinated inner neck. Coarse fabric with dull-red slip. Very common in Periods II, III and IV. The illustrated specimen is from Period II.

Type 4 is the upper portion of a small vessel with a splayed-out rim on a sharply carinated inner neck. The rim has prominent corrugations on its outer surface. Medium fabric with whitish core and greyish black slip. A unique type from Period II.

Type 5 is the rim of a large vessel slightly thickened internally and externally at the top. Coarse gritty fabric with drab colour. The type is plentiful in Periods III and IV, the illustrated specimen being from the latter.

Type 6 is the upper portion of a large jar with a rim thickened in the middle but more pointed at the top and perched on a neck with an inner carination. Coarse fabric with dull-red slip. A rare specimen from Period III.

Type 7 is a shallow dish with an incurved rim and a presumably flattish base. Fine fabric with dark-grey core and black slip. The type is associated with the corresponding types in N.B.P. ware and is common in Period II.

Type 8 is the upper portion of a large jar with the rim thin at the top, set on a neck with a prominent inner carination. There are a few irregular scratches on the inner rim. Medium fabric with red slip. The type is a rare one occurring in Period III.

Type 9 is a large shallow basin having a rim with an inconspicuous outer collar and a body with shallow corrugations. Medium fabric with brownish slip. A rare type from Period II.

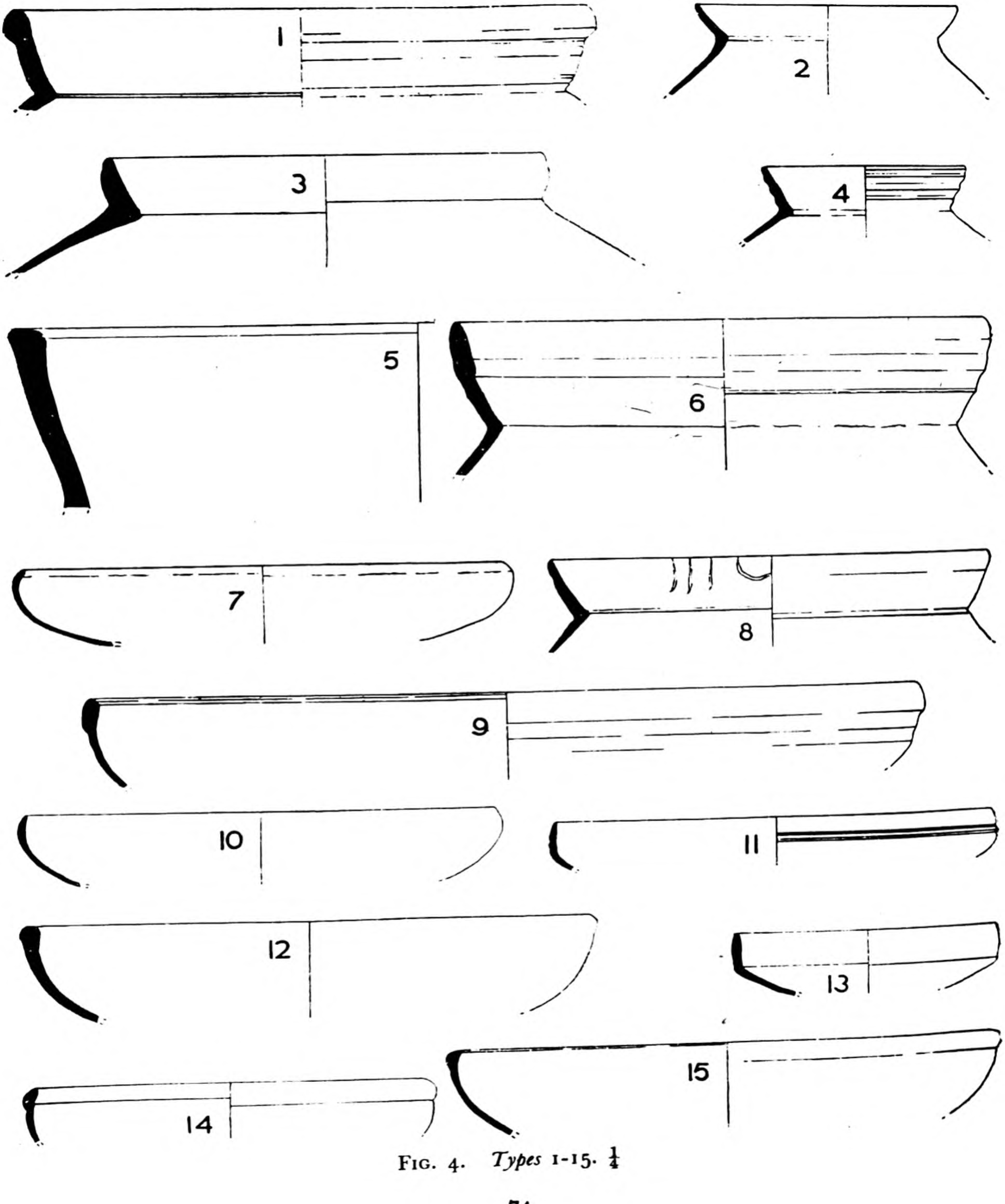
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FIG. 4. *Types* 1-15. ¼

Type 10 is a dish with an incurved rim and a presumably convex base. Fine fabric with a burnished surface and grey slip. A common specimen from Period II.

Type 11 is a dish with a fairly vertical sharpened rim and a presumably convex base. The body has a sharp groove below the neck. Fine fabric with a polished surface and black slip. A rare specimen in Period II.

Type 12 is a dish with a thickened vertical rim and a presumably convex base. Medium fabric with dark-red slip on both surfaces. A common type in Period II.

Type 13 is a dish with a sharpened vertical rim and a sagger base. Medium fabric with dull-red wash. A rare specimen from Period IV, where it is out of context, as the type is connected with shapes occurring in Period II.

Type 14 is a dish with a slightly incurved and beaded rim sharpened at the top. There is a groove between the rim and the body. Fine fabric with external and internal red slip and a smooth surface. A rare specimen from Period II.

Type 15 is a dish with an incurved beaded rim. Fine fabric with a smooth red-slipped surface with patches of chocolate-coloured slip inside. A rare specimen from Period II.

Type 16 is the upper part of a jar with a flaring beaked rim. Coarse micaceous surface with red slip. A rare specimen from Period IV. *Type* 16*a* is a variety of the same with a sharper concave neck.

Type 17 is a jar with an externally chamfered rim, an ovoid body and an inconspicuously pointed base. The specimens of the type are roughly potted in medium fabric with red slip on both surfaces. A common type in Period IV.

Type 18 is the upper part of a jar with an externally obliquely-cut rim and a vertical high neck. Coarse fabric with black core and drab exterior. Common in Periods III and IV, the illustrated specimen being from the former. *Type* 18*a* is a variant of the same, also common in Periods III and IV.

Type 19 is similar to type 18 but has a thinner and more concave neck with a groove on the externally chamfered rim. It is common in Period IV.

Type 20 is a jar with a flaring featureless rim, a concave neck and a globular body. Fine fabric with partly black core, red slip inside and un-uniform black slip outside. A unique specimen from Period II.

Type 21 is similar to type 17 but has a vertical rim. Roughly potted in medium fabric, with red slip on both surfaces. Common in Period IV.

Type 22 is a small vessel with a featureless flaring rim, a concave neck and a spout on the body. Medium fabric with red internal and external slip. A unique unstratified find.

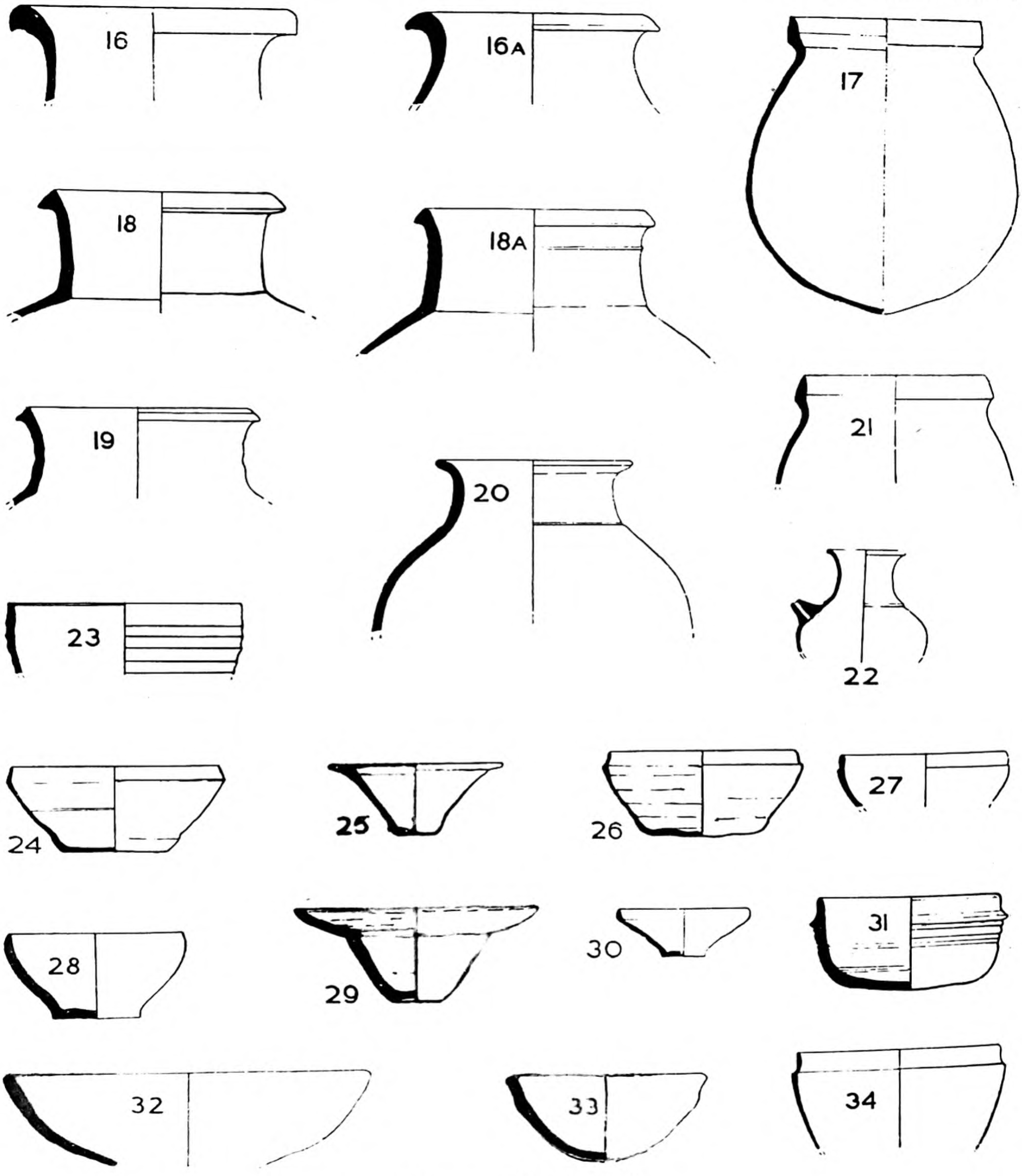
Type 23 is a deep bowl with a featureless vertical rim and an externally corrugated body. Fine fabric with grey core and bright grey slip on the burnished inner and outer surfaces. A unique specimen from Period II.

Type 24 is a bowl with a slightly inturned featureless rim and a slight constriction above the flat base. Medium fabric with a grey surface and core. A rare specimen from Period II.

Type 25 is a small lid with a flat splayed-out rim and a flattish base. Coarse fabric with red slip. A unique unstratified specimen.

Type 26 is a bowl with a slightly inturned featureless rim and an inconspicuous carination separating the rim and the body. Coarsely potted in medium fabric with a black surface and core. The type is plentiful in Period II.

Type 27 is a small bowl with a vertical featureless rim and an inconspicuous carination below it. Fine fabric with grey core and grey slip on the exterior. A rare specimen from Period II.


16
16A
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18A
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34

FIG. 5. *Types 16-34.* ¼

Type 28 is a bowl with a vertical to slightly incurved sharpened rim and a flat base. Medium fabric with dull-red slip on both surfaces. The type is abundant in Period III.

Type 29 is a bowl with a splayed-out rim separated from the body by an inner carination and with a concave base. The rim is wheel-made but the body is hand-made. Traces of luting between the two parts are visible. Fine fabric with red internal and external slip. A rare specimen from Period II.

Type 30 is somewhat similar to type 28 but the rim is vertical to inturned. Medium fabric with bright red slip on both surfaces. The type is abundant in Period IV and forms a link between that Period and Period III, where specimens of a larger size are available.

Type 31 is a bowl with a featureless vertical rim separated from the vertical body by a fairly conspicuous flange, possibly to receive a lid. Medium fabric with dull-red slip. A unique specimen from Period III.

Type 32 is a bowl with a featureless splayed-out rim and a sagger base. Medium fabric and drab colour. A rare specimen from Period II.

Type 33 is a small deep bowl thickened between the rim and the body and with a sagger base. Medium fabric and drab colour. A rare specimen from Period II.

Type 34 is a deep bowl presumably with a sagger base and with an inset rim on a flange, which, like type 31, was probably intended for receiving a lid. A common type in Period II.

(*iii*) *Painted and decorated sherds, I-VI* (*fig.* 5)

No. I is a sherd of medium fabric and grey core with red slip. It is painted with three lines n grey colour on the exterior. Period IV.

No. II is a sherd, presumably the base of a dish, with grey core and red slip and is incised with three concentric circles. A unique specimen from Period IV, where it may be out of context.

No. III is the fragment of a small jar with a very narrow neck and bulbous body in fine fabric, the core partly red and partly grey. The inner surface is grey. The outer surface, which has red slip, is painted with irregular lines in chocolate trickling down to red. Period II.

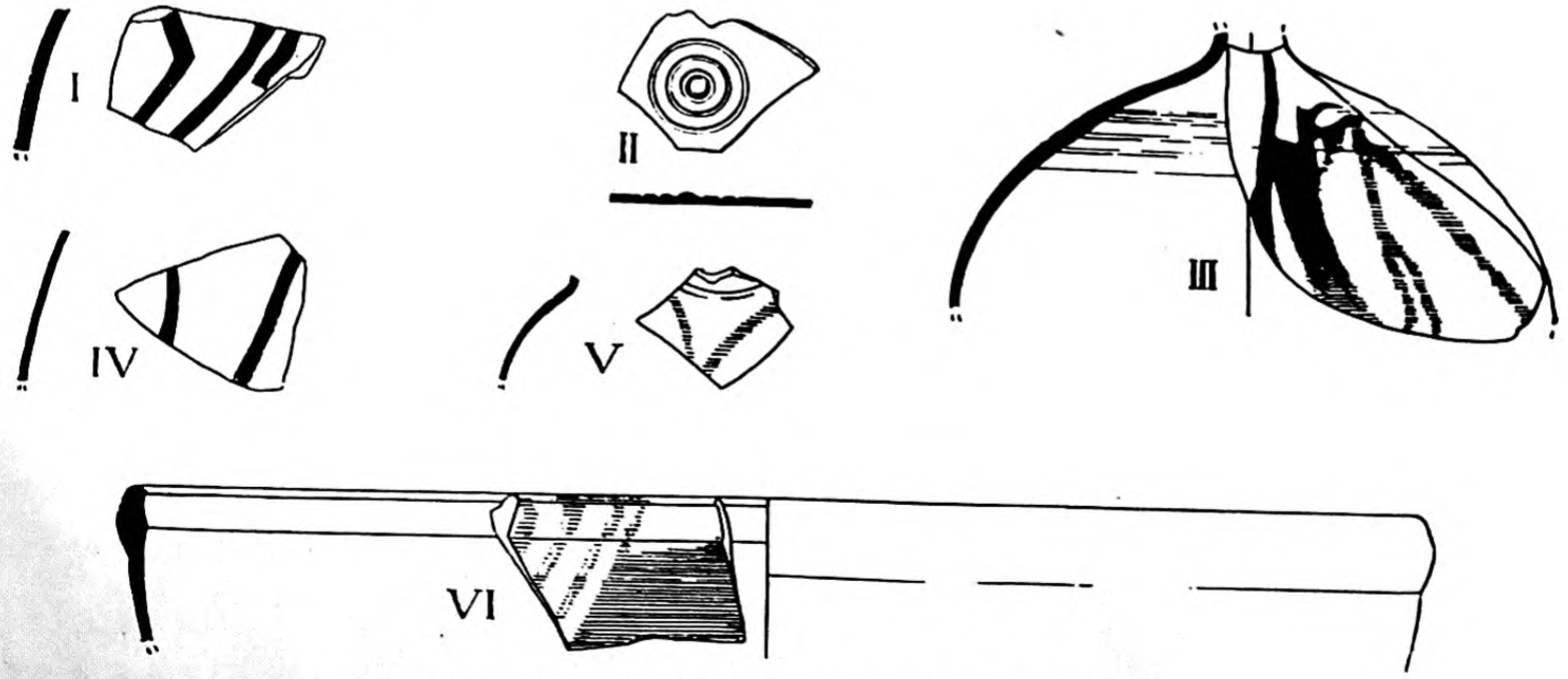

FIG. 6. *Painted and decorated sherds, I-VI.* ⅓

No. IV is a sherd of fine fabric with grey core and red slip on both surfaces. It is externally painted with two lines in black. Period III.

No. V is the fragment of a small jar of fine fabric with a polished and black-slipped outer surface, which is painted with two yellow lines. Period II.

No. VI is the fragment of a bowl with a thickened rim thinner at the top. Medium fabric with dull-red slip. Internally painted with a horizontal band at the rim and oblique lines below in black. Period II.

5. OTHER SMALL FINDS (PL. XXXIII)

Due to the limited extent of the operation, the small finds were very few in number. Mention may, however, be made of the following :—

1. Head of a terracotta animal-figurine. Eyes indicated by a deep incision and ears by pellets of clay. Unstratified.

2. Headless terracotta animal-figurine. Row of circular punches all over the body. Period II.

3. Torso of a female figurine with drapery clinging to the body. An indistinct object, probably a vessel, held in the hanging left arm ; right arm slightly bent. Seems to be wearing heavy ear-ornaments. Period IV.

4. Headless terracotta bird-figurine. Plumage indicated by incision on body. Unstratified.

5 and 6. Two of the six terracotta beads found together in layer 5. Period IV.

7. A plain double-convex toy-wheel. Unstratified.

TECHNICAL SECTION

THE WEIGHTS OF THE PUNCH-MARKED COINS FROM BARWĀNI (MADHYA BHARAT)

By T. R. Gairola

In 1943 a hoard of 3423 silver punch-marked coins was discovered at village Pāti in Barwāni State (now a part of Madhya Bharat) and was forwarded by the Diwan. of the State to the Director General of Archaeology. The coins are being studied and classified by Dr. K. N. Puri, Superintendent of the Northern Circle, and it is hoped that his work will shortly be published as a Memoir of the Survey. In the meantime the results of the analysis of the weights of the coins by Mr. T. R. Gairola, Assistant Archaeological Chemist, are published here, for, as has been suggested by scholars working in the line, an accurate recording of the weights of the punch-marked coins is of great importance in the determination of the length of their circulation, as the loss of weight has in all probability a bearing on the number of the symbols on the reverses of the coins.

A STUDY of the weights of 3423 silver punch-marked coins discovered at Pāti in Barwāni, Madhya Bharat, shows that a majority of them weigh between 3·6 gms. and 3·1 gms. Table I gives the number of coins with different ranges of weights.

TABLE I

Range of weights in gms.	*Average*	*No. of coins*
3·6498-3·5500	3·6	48
3·5498-3·4500	3·5	542
3·4498-3·3500	3·4	1,502
3·3498-3·2500	3·3	954
3·2498-3·1500	3·2	247
3·1498-3·0500	3·1	68
3·0498-2·9500	3·0	29
2·9498-2·8500	2·9	22
2·8498-2·7500	2·8	6

If a curve is plotted on Hemy's lines[1] with the data given in Table I, it is found that there is a peak-point in the curve at 3·4 gms. weight (fig. 1). Allowing one per cent for the loss of weight due to wear-and-tear and corrosion, the probable weight corresponding to this peak-point comes to 3·43 gms., which is equivalent to four times the smallest weight-unit (·86 × 4=3·44 gms.) of the Harappā culture.[2] Thus, it seems likely that the weight-standard of the Barwāni hoard is akin to that of Mohenjo-daro, the slight deviation being due to wear-and-tear, corrosion and errors during minting.

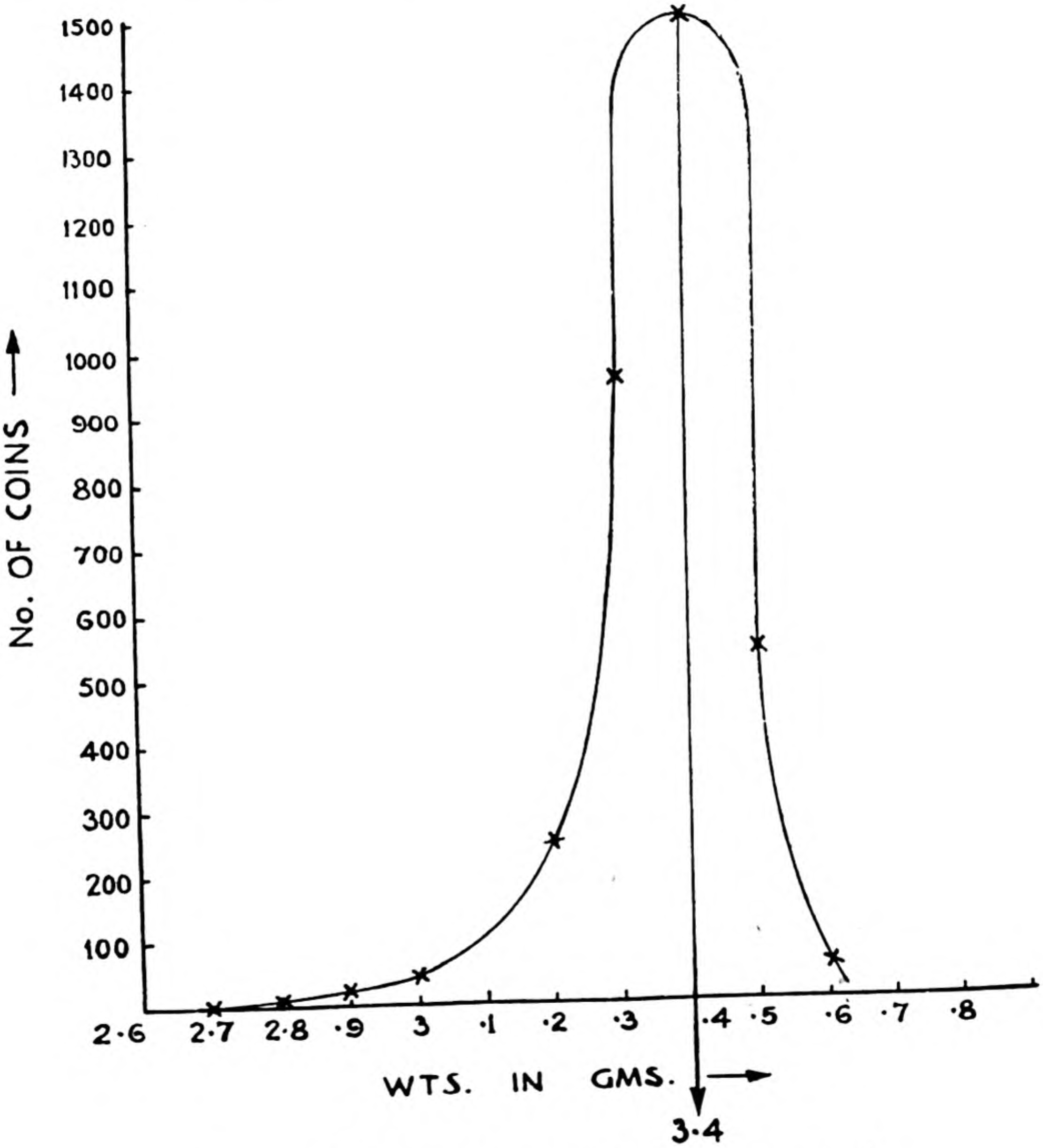

FIG. 1. (Cf. *Journ. Roy. Asiatic Soc.*, Jan. 1937, p. 9)

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[1] A. S. Hemy in *Journ. Roy. Asiatic Soc.*, Jan. 1937, pp. 1-25.

[2] J. Marshall, *Mohenjo-daro and the Indus Civilization* (London, 1931), II, pp. 589-598.

Table II shows that the number of coins falls with the increase in the number of reverse-symbols and gives the curve in fig. 2 if a graph is plotted. The condition of the wear-and-tear of the coins suggests that those with a higher number of reverse-symbols were in circulation for a longer period.

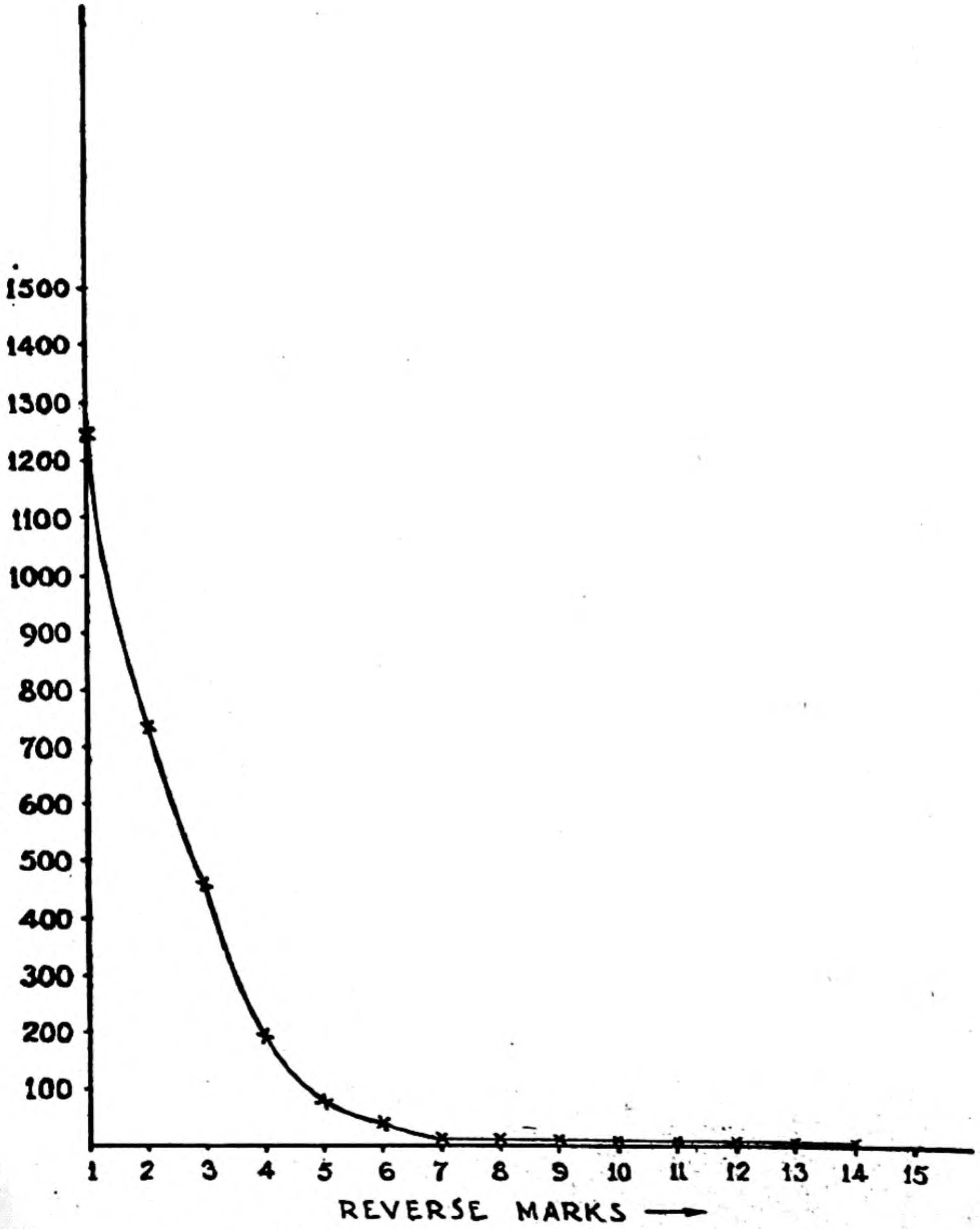

FIG. 2. (Cf. *Current Science*, July 1940, p. 313)

TABLE II

No. of reverse-symbols	*No. of coins*[1]
1	1,243
2	733
3	457
4	194
5	77
6	41
7	12
8	15
9	8
10	7
11	3
12	2
13	3
14	3

Table III shows the coins arranged in order of the numbers of their reverse-symbols and weight-group.

TABLE III

No. of reverse-symbols	Number of coins in each weight-group					
	3·5748-·5250 3·55 gms.	3·5248-·4750 3·50 gms.	3·4748-·4250 3·45 gms.	3·4248-·3750 3·40 gms.	3·3748-·3250 3·35 gms.	3·3248-·2750 3·30 gms.
0	...		10	3	1	...
1	49	131	256	334	247	135
2	21	47	131	184	187	87
3	10	24	53	95	135	75
4	3	3	28	39	47	32
5	...	...	2	3	15	13
6	...	...	1	4	6	5
7	...	...	...	...	1	2
8	...	...	...	...	...	3

Plotting Hemy's curves for each group of reverse-symbols, the weights are found as follows from the peak-points of the curves.

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[1] Coins bearing illegible marks have been excluded.

TABLE IV

No. of reverse-symbols	Standard-weight	Remarks
1	3·3900	from Curve A (fig. 3)
2	3·3700	from Curve B (,,)
3	3·3575	from Curve C (,,)
4	3·3500	from Curve D (fig. 4)
5	3·3275	from Curve E (,,)
6	3·3200	from Curve F (,,)

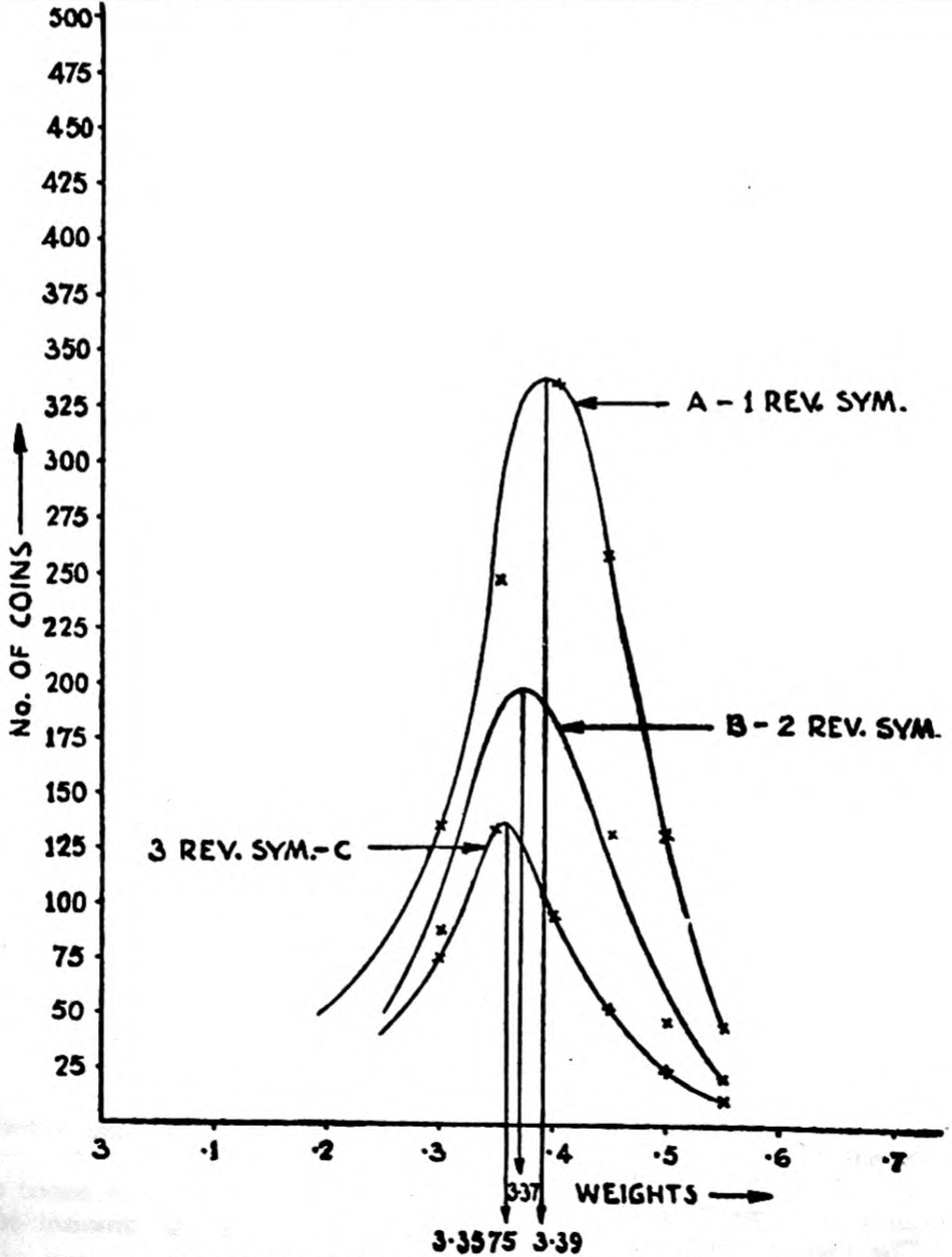

FIG. 3. *Standard weights of coins bearing 1,2 and 3 reverse-symbols*

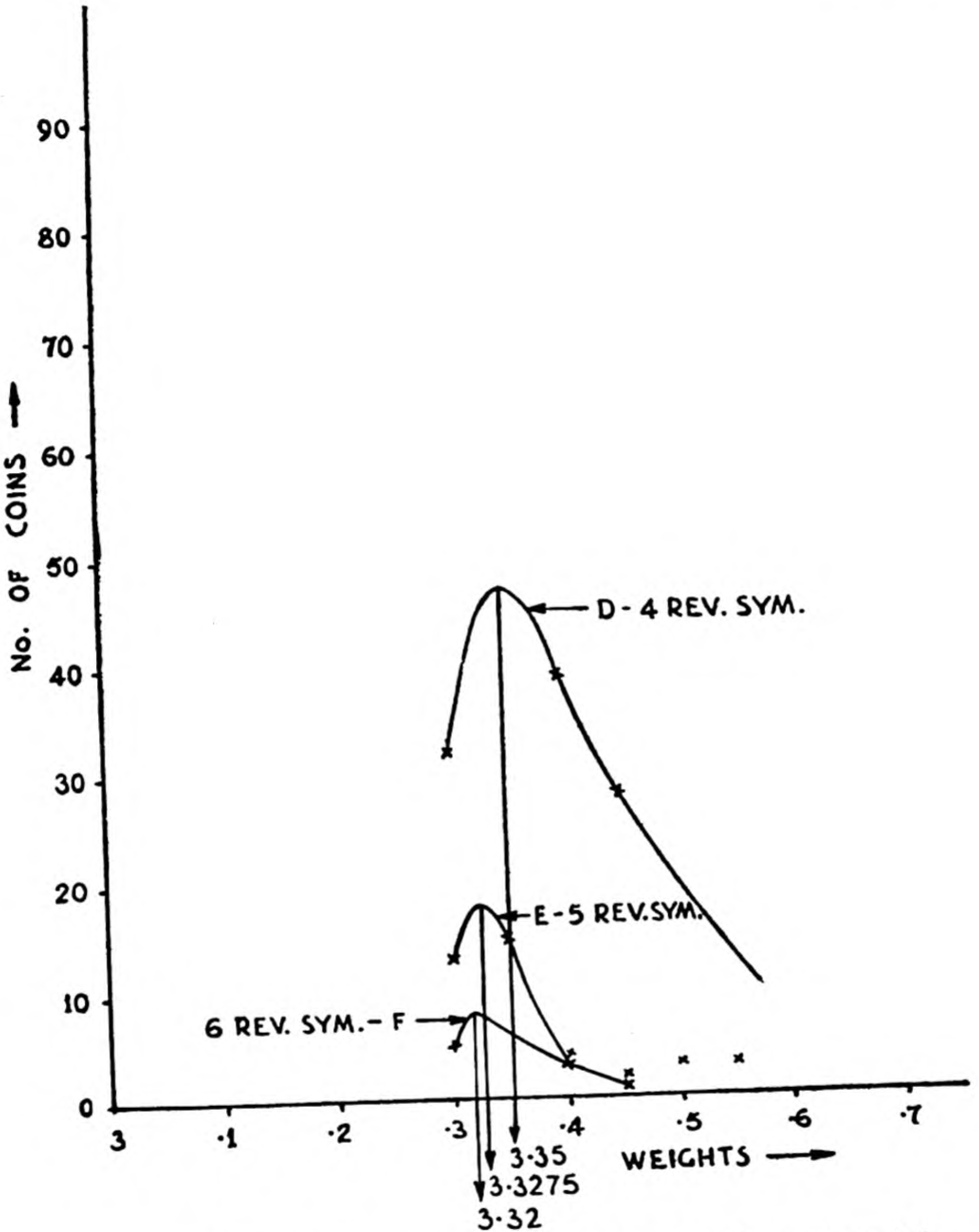

FIG. 4. *Standard weights of coins bearing* 4, 5 *and* 6 *reverse-symbols*

The standard-weights thus fall uniformly with the increase of the reverse-symbols[1] and, when plotted, give the line GH, shown in fig. 5. The linear regression is found to be given, on calculation by the equation $y=3{\cdot}4088-{\cdot}0158\,x$, where y represents the standard-weight and x the number of reverse-symbols. The loss of weight between the successive reverse-symbols is indicative of the length of the period during which the coins had been in circulation.[2]

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[1] D. D. Kosambi, 'A statistical study of the weights of old Indian punch-marked coins', *Current Science*, July 1940, pp. 312-314.

[2] The Master of Mint, His Majesty's Mint, Calcutta, in his letter dated the 4th July 1945, informed me : 'The loss of weight in coins is primarily caused by the amount of circulation they have endured.'

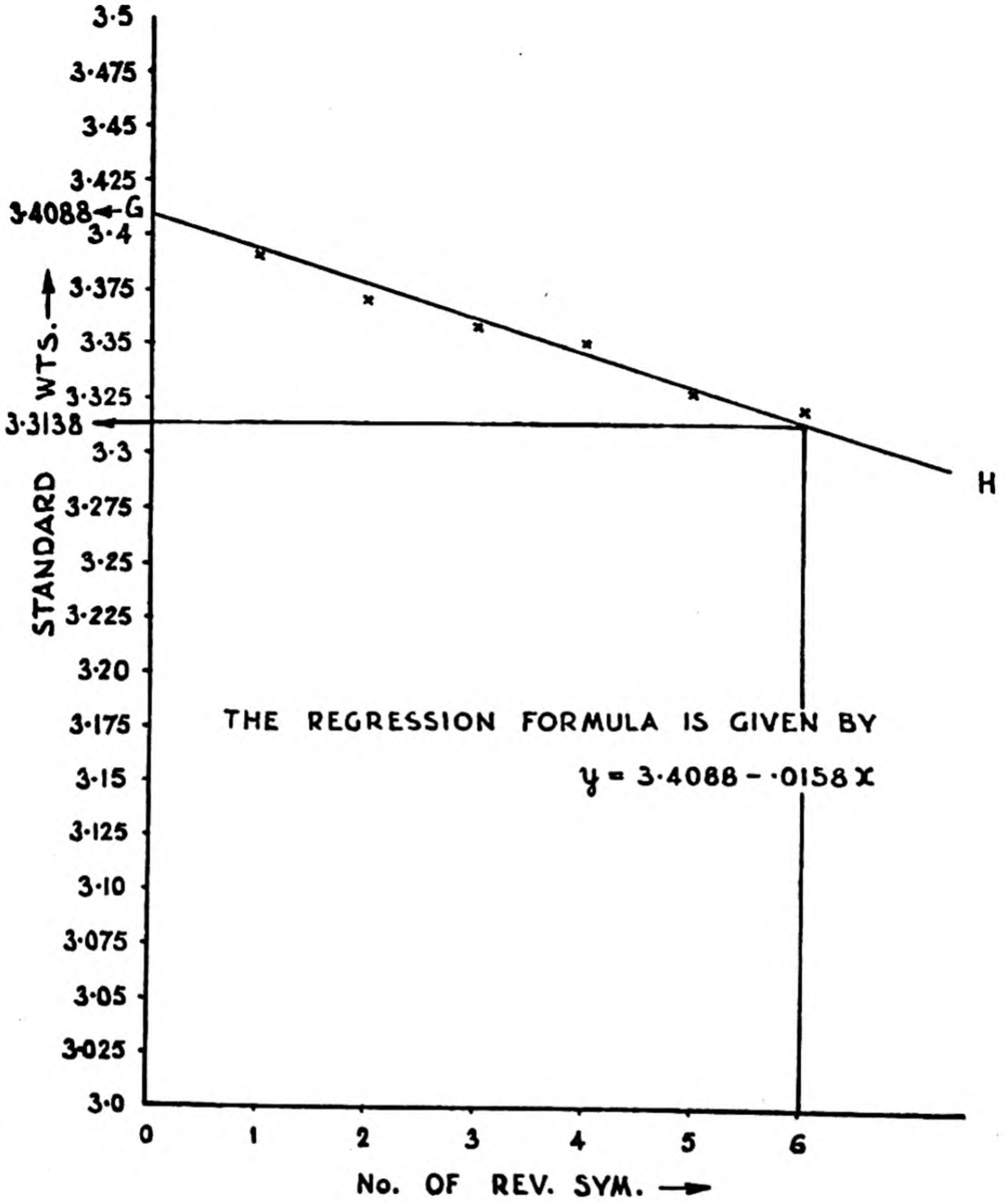

FIG. 5

$$y = mx + c$$
$$3{\cdot}4088 = 0 + c$$
$$3{\cdot}3138 = 6\,m + 3{\cdot}4088$$
$$\therefore -m = \frac{{\cdot}0950}{6} = {\cdot}0158$$
$$\text{or } m = -{\cdot}0158$$

i.e. ·0158 *is the discount on the value of each reverse-symbol.*

We are therefore led to confirm the theory that the reverse-symbols were fixed during the circulation of the coins at regular intervals. Systematic chemical analyses combined with a study of weights may, however, throw further light on the relationship of the number of reverse-symbols on the coins and the duration of their circulation.

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